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PROCEEDINGS OF

THE LINNEAN SOCIETY OF LONDON

156th Session (1943–44) Part 3

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PROCEEDINGS OF

THE LINNEAN SOCIETY OF LONDON

156th Session (1943–4) Part 3

PROCEEDINGS OF THE GENERAL MEETING
8 June 1944

held jointly with the Zoological Society of London.

Mr. A. D. Cotton, O.B.E., President,
in the Chair.

The Proceedings of the Anniversary Meeting held on Wednesday, 24 May 1944, having been circulated, were taken as read and confirmed.

Professor F. E. Weiss, F.R.S., was thanked for a gift made to the Library since the last meeting.

The following Fellows signed the Obligation in the Book of the Charter and Bye-Laws and were admitted :—Dr. Geoffrey Clough Ainsworth, Dr. William Gladstone Templeman, Miss Norma Mary Waterman and Dr. Henry Newcome Wright.

The following candidates, whose names were read for the third time, were balloted for and elected Foreign Members :—Dr. Liberty Hyde Bailey and Dr. V. Dogiel.

The President reported the deaths of Alfred William Oke and John Roxbrough Norman, Fellows of the Society.

The President announced his appointment of Vice-Presidents :—Mr. I. H. Burkill, Dr. E. Hindle, F.R.S., Prof. D. L. Mackinnon and Col. F. C. Stern, O.B.E., M.C.

The following communications were read and discussed :—

Col. F. R. S. Balfour, C.V.O. Archibald Menzies and his exploration with Vancouver of the north-west American coast. (Discussed by Dr. E. Hindle, F.R.S. The President expressed the thanks of the Society for the paper and for the donation to the Society of a transcript of Menzies' 'Journal'.) [Printed in full, below.]

Dr. F. C. Fraser. A specimen of the Southern Bottle-nosed Whale (*Hyperoodon planifrons*). Description of a rare southern cetacean. (Discussed by Dr. Malcolm Smith, Prof. A. J. E. Cave, Dr. S. M. Harding, Dr. E. Hindle, F.R.S., Dr. N. A. Mackintosh, Mr. R. H. Burne; Dr. Fraser replied.) [This paper will be published by the Zoological Society.]

Dr. F. E. Zeuner, F.Z.S. Reconstructions of Pleistocene Mammals —II. Woolly Rhinoceros (*Tichorhinus antiquitatis* Blum.) and Merck's Rhinoceros (*Dicrorhinus mercki* Jäg. syn. *D. megarhinus* de Christ.). (Discussed by Professor A. J. E. Cave.) [Printed in full, p. 183.]

A communication on Wicken Fen by a member of the Wicken Fen Committee was unavoidably postponed.

ARCHIBALD MENZIES, 1754–1842, Botanist, Zoologist, Medico and Explorer.

By F. R. S. Balfour, C.V.O., M.A.

As I recently became possessed of the papers and relics of Archibald Menzies by the death on 30th June last of his great grandnephew, C. D. Geddes, of Edinburgh, and as the centenary of Menzies' death has recently passed, it was suggested to me by our President that I might appropriately address the Society on his life and work. The diplomas, charters and relics I have presented to the Provincial Archives at Victoria, British Columbia, and certain of the papers to the Library of the State of Washington at Seattle.

As is generally known, 'Z' in Scots is the equivalent of 'Y' and should be so pronounced. To those who would understand this confusion in typography I would recommend the exhaustive explanation of this matter in the 'Etymological Dictionary of the Scottish Language' by J. Jamieson, under the letter 'Y'.

When he died on 15 February 1842, Menzies was the father of the Society and left to it £100. He had survived by a few weeks A. B. Lambert who became a fellow in 1788, two years before Menzies.

There are two portraits of Menzies, both by Eddis. Fellows are familiar with one of them which hangs behind me: the other is a drawing at Kew. Both were made when he was an old man in 1836 and had been elected to the Council of this Society. (I may here interpose the remark that Eddis painted your lecturer forty-two years after he had painted Menzies!) I became possessed of his miniature painted before middle life. [A lantern-slide of this was shown.]

He was born at the house of Styx or Stix four miles from Aberfeldy on the Tay in the heart of the Menzies country on 15 March 1754. In the court book of the Barony of Weem the first mention of the name is of an Alexander Menzies of Stuikis as being on the Assize of 1629. Among the papers I became possessed of are six Sasines relative to the lands of Stinx or Stanx from 1580 onwards. These, Menzies and his forbears had carefully preserved. The word comes from the Gaelic Stuicean meaning Stocks and probably originated from an ancient stone circle which exists

close by. I know little of his forbears except that his father's name was James and his mother's Ann, but among the papers I received were two reports made in 1769 by an Archibald Menzies, on the forfeited estates of Barrisdale and Lovat: I think he must have been our Archibald's uncle. Menzies had three brothers and four sisters, all of whom he survived. The family was probably a sept of the Menzies of Culdares.

When he left the parish school at Weem he worked for a time in the garden at Castle Menzies. The laird at that time was the 3rd Baronet, Sir Robert Menzies of Menzies. A sidelight on the life of the place is revealed by a record of the factor's accounts at Castle Menzies for December 1832, when the majority of the dozen or so employed in the garden were of the name of Menzies, and the wages of the men were 4*s*. 7*d*. a week and of the women 2*s*. 9*d*.!

He proceeded to Edinburgh, where he worked under Dr. John Hope the then teacher of Botany at the University. His elder brother William was already employed at the Edinburgh Botanic Garden. Among the papers I received were the Diplomas, on vellum, admitting later both brothers to membership of the Natural History Society of Edinburgh University and signed by the distinguished Professor John Walker. Dr. Hope commended later the young Archibald for the herbarium collection he made in the highlands for Drs. Fothergill and Pitcairn in 1778, of the rarer Scottish plants.

He took his degree in medicine in Edinburgh in 1781 and practised for a time at Carnarvon. He soon, however, entered the Navy as assistant surgeon and was under Rodney in the victory of 12 April 1782, over the Comte de Grasse.

After the peace he served for four years as surgeon on the 'Assistance' on the Halifax station, where he made himself familiar with the flora of coastal eastern America, and also collected in the West Indies when his ship made visits there. When later he saw the trees and shrubs of the Pacific Coast he mistakenly identified most of them with their eastern counterparts: he did not realize, and neither did David Douglas forty years later, that no ligneous species (with exception of a maple and two willows) is common to both coasts of the Continent.

From Halifax Menzies wrote his first letter to Sir Joseph Banks, on 30 May 1784, when he sent him seeds collected near New York early that year, and in Barbados and other W. Indian Islands in March. In August 1786 he wrote to Banks from Chatham that he would like to be appointed surgeon on the 'Private Adventurer' then fitting out at Deptford. It was in that year that Dr. John Hope, then Curator of the Edinburgh Botanic Garden, recommended his former pupil to the especial attention of Banks. Dr. Hope died later in the same year. The introduction led to his appointment as surgeon on the 'Prince of Wales' owned by the enterprising firm of John and Cadman Etches & Co. This little ship, commanded by Captain Colnett, with the sloop 'Princess Royal', set off in September 1786 for the North Pacific Coast via Cape Horn.

They made direct for Nootka Sound on the west side of the land that Vancouver in 1792 proved to be an island and which he called by his name. It was then in the hands of the Spanish. Nootka is now a little-known place, but its name is familiar to us from the several well-known

plants to which it is applied, all first seen by Menzies, e. g., *Cupressus nootkatensis*, *Rosa nutkana* and *Rubus nutkanus*. It was at Nootka that Captain Cook had first landed on the coast and a monument to record that event was erected some twenty years ago.

The voyage round the world took three years; but we know little of what that expedition accomplished, as the Spaniards seized Captain Colnett's papers when they fell foul of him on the North-West Pacific Coast. I believe these documents have now been recovered from Madrid but have not yet been published. Some of Menzies' notes of localities in his descriptions of his plants in the British Museum (South Kensington) indicate places reached, and in the diary of his subsequent voyage with Vancouver he makes scattered references to this. The 'Prince of Wales' got home in July 1789 by the Cape of Good Hope, having visited Hawaii and New Zealand after leaving the NW. American coast. On his return Menzies became a Fellow of this Society in 1790, and the Society published papers from his hand on *Echenis liniata*, *Fasciola clavata* and *Hirudo branchiata* in 1791.

In his letter of 14 July 1789 to Banks announcing his return, he tells of the scurvy from which the crew had suffered on their way to Nootka but which soon disappeared on their arrival, no doubt from the 'Spruce beer' which they brewed. Probably Western Hemlock was the conifer used. Captain Cook had shown how that scourge of earlier expeditions could be exorcised. He reports the interesting find in a native's hands of a polished brass weapon inscribed 'Jos. Banks Esq.', a relic of Banks' voyage with Captain Cook of 1767. The island of this find was named after Banks in commemoration; it lies inside Queen Charlotte Islands.

The attraction in those days which took traders to the NW. Pacific Coast was the sea otter, now alas, virtually extinct except in the Aleutian Islands. It is a confiding animal with an engaging habit of rearing itself half out of the water and holding up its cubs for the boatmen to see. In Menzies' time ships came to get this much prized fur for the China market. The animal is now protected but far too late; no pelt has appeared in the London market since 1911 when one was sold for £475. Menzies makes frequent reference to the attempts, often unsuccessful, to get Indians to part with the skins. However, on 20 July he secured 200 of them, a notable haul. He wrote a paper, jointly with Sir Everard Home, published in the Transactions of the Royal Society in 1796, on the 'Anatomy of the Sea Otter'.

Menzies soon became restive under the inactivity of home life and was importunately writing to Sir Joseph Banks begging for his influence to get him sent by Government on a second long voyage. By February 1791 we find him at Portsmouth. Captain Vancouver had arrived to take over the command of the 'Discovery' on which Menzies had been appointed to serve as naturalist at the instance of Banks. Among the papers which I received, and which Menzies had carefully preserved all his life, was a long letter from the great man, written on 22 February 1791, from his house in Soho Square. This gave most explicit instructions to Menzies (see Appendix). Menzies' reply, preserved in the Banksian correspondence at the British Museum, South Kensington, is docile and subservient;

indeed, to our ideas not at all the attitude that one man of science should adopt to another. He signs himself 'your most obedient humble servant', and this was not a formality but the tone of their relationship. It is hard for us in these days quite to realize the proudly domineering attitude of Banks in the world of science of his day. As we all know he had accompanied Cook in 1767.

That Menzies kept his word of recording all he saw and did is evident in his daily Journal, which forms the basis of what we know of his achievements. The history of this voluminous work (of which I am fortunate to possess a complete transcript in 5 volumes) is that it came up for sale at Sothebys on 13 March 1886. It must have belonged to the representatives of Banks, as at the same sale there appeared other Banksian MSS. The sale lot is number 977 containing the diary; it was mis-described in the catalogue as the Journal of Banks in the 'Discovery'. It then consisted of 3 volumes of 420 folios. The British Museum number is 'Add. MS. 32641.' In the Journal I have found occasional entries such as on page 1308 :—

> 'I have the pleasure to add these plants were brought home to England and placed in his Majesty's garden at Kew,'

which clearly indicate that the Journal now in the B.M. was written out fair by Menzies after getting home. Part of the Journal which relates to the Sandwich Islands and edited by W. F. Wilson was published in Honolulu in 1920 under the name 'Hawai Nei'. In 1923 the Archives of British Columbia published 'Menzies Journal of Vancouver's Voyage' under the very able editorship of the late Dr. F. C. Newcombe. That part which covers California was published in 1924 in 'The Quarterly Journal of the California Historical Society,' vol. II, no. 4.

At the conclusion to-day I propose to present to the Society my five volumes of the transcription, bound in half leather of my own Dawyck deer-skin.

The 'Discovery', a sloop of 330 tons under Captain George Vancouver, who had been a midshipman under Captain Cook, and the 'Chatham', a brig of 140 tons under command of Lieut. W. R. Broughton, sailed from Falmouth on 1 April 1791 for the North-American Pacific by way of the Cape of Good Hope, New Holland (Australia), New Zealand, Tahiti and Hawaii, or, as Menzies calls it, Owyhee. The voyage was uneventful. Menzies notes carefully any new bird he saw: he records in October *Phoca ursina* at the first landing in Australia, also *Haematopus fulginosus* and *Haematopus novae hollandiae* which he described. In November he made a collection of ferns and mosses in New Zealand, near Dusky Bay. Sir J. E. Smith said it was 'the richest collection of Jungermanniæ that was ever perhaps made by any one person'. At Facile Harbour the crew brewed beer from 'New Zealand Tea' though he leaves us in ignorance as to what the species was. They found that the chart made by Captain Cook eighteen years earlier of this part of the New Zealand coast was accurate and helpful. Menzies makes frequent mention of the Albatrosses, terns, shearwaters and petrels of several kinds. Since leaving Facile Bay nothing had been seen of the 'Chatham' till they made 'Otahaiti' (Tahiti) on 29 December where they found her lying at anchor.

Lieut. Broughton had discovered and named en route Chatham Island, where he raised the British Flag in token of possession.

After some days in the Sandwich Islands, on 17 April 1792, the coast of Drake's New Albion, as California was then called, was sighted. The British Columbia publication includes the Journal from that date till 13 October of the same year, when the exploration of the intricacies of Puget Sound and the waterways surrounding Vancouver Island were completed.

I first made acquaintance with the North-West Pacific Coast in 1900, and it is, of course, of supreme interest to me to read Menzies' and also Vancouver's account, of the long explorations by open boat through the Sound which they named after their First Lieutenant Peter Puget. These culminated in a close view of Mount Rainier, one of the two highest mountains in the United States (14,526 ft.), when in boats on 20 May they reached an islet of the Sound far inland on which the town of Tacoma now stands. A drawing of this appears in Volume 2 of Vancouver's Voyages, and a recent photograph of the mountain taken at timber line shows the profusion of flowers and scattered trees of *Abies amabilis* in these incomparable alpine meadows, which I first reached on horseback forty-four years ago. Professor Sargent once said to me that in his long botanical experience this alpine region had no rival unless it was in some of the alpine valleys of the Tyrol.

The explorers had previously seen at a distance of twenty leagues to the north-eastward as they came up the Straits of Juan de Fuca, another great snow-covered mountain which was named by them Mount Baker, after their officer Lieutenant Joseph Baker, who first saw it. This is 10,827 ft. and a very impressive landmark on the present Canadian-American boundary.

It is to be regretted that owing to the almost 'impenetrable stretches of Pinery ' as Menzies called it, with which all that country is clothed to the water edge, Menzies had no single opportunity of reaching timber line and bringing home the rich herbarium of new species he would have found. Of the great conifers of the region he never recognized the prevailing species, the Douglas fir, as belonging to a genus he could never before have seen. All the conifers were ' pines ', a name which still survives in the word ' pinetum ' we apply to all conifer collections. His ' Silver fir ' was no doubt *Abies grandis*, which is found at sea-level in the valleys. The great *Arbutus* which bears his name (given to it by Pursh) he first records on 2 May, and calls it the oriental strawberry tree. It is the finest evergreen of the North West. [A lantern-slide of a photograph received from a botanical friend in California showed the largest known specimen of *Arbutus Menziesii*.] The names of many other trees and shrubs of the region occur constantly in the Journal, the maple (*Acer macrophyllum*), alder (*Alnus oregona*), rhododendron called by Menzies *R. ponticum*, but actually *R. californicum*, is now the state plant of Washington; dogwood—*Cornus Nuttallii*—the most striking of all trees of the Pacific Coast when clothed with its snow-white bracts.

Menzies mentions all the birds and animals he saw. It is noteworthy that he never speaks of seeing or hearing from Indians of wapiti, the largest animal of the Pacific Coast, which indicates that it was no commoner

then than now, when its coast habitat is confined to the Olympic Range and Vancouver Island. He does, however, mention that the Indians span and wove a white wool from some animal he never saw : unquestionably it was the Rocky Mountain goat. In the islands of Puget Sound black-tailed deer, *Odocoileus columbianus*, were common and provided excellent venison for officers and men. Over forty years ago I imported the first herd of these animals to reach this country. I put them in sailing ships which came round Cape Horn. Seven were shipped and eight arrived. Unlike the trees of that country the climate of Scotland proved unfavourable to this species.

By 19 August the two ships emerged from the Sound of Georgia to the open sea and had accomplished the first circumnavigation of what was soon to be called Vancouver Island. The passage had been a risky one in those foggy, rocky channels. The ' Discovery ' had gone firmly aground on a sunken rock on 6 August but floated off on a rising tide next day without damage. The ' Chatham ' was grounded on the following day.

At Nootka they found Señor Quadra, the Spanish officer in charge of the port and settlement. To him Vancouver presented the letter he had brought from England signed by Count Florida Blanca, in which Spain formally renounced her pretensions to that northern coast in favour of the British. Their relations were of the friendliest though Quadra refused to give up more than the insignificant site of a previous British headquarters. The two on 5 September agreed to name the great area circumnavigated by Vancouver as ' Island of Quadra and Vancouver '. They sensibly agreed to differ as to the possession of the island and referred the matter back to George III and His Catholic Majesty for final decision. They made rendezvous at ' Monterrey ' (so spelled by the Spaniards and Menzies) in California. Quadra sailed first, and in October the ' Discovery' and ' Chatham ' also set out for San Francisco. The voyage was tempestuous, which prevented the ' Discovery ' from crossing the bar of the Columbia River and making the first ascent of that great river in company with the ' Chatham '.

During the expedition up the river Lt. Broughton saw and named Mount Hood after the Admiral. He also named an island in the river after Menzies who, however, was of course on board the other ship. He proclaimed the river and adjacent country as of the dominion of H.M. George III. Strange that this it seems was ignored when the Canadian and American boundary was settled some sixty years later. By this time the health of the surgeon of the ' Discovery ' had necessitated his return home by the first available fur trader from Nootka and Menzies was appointed to succeed him.

The Spanish Garrison at the Presidio at San Francisco and the Franciscan Fathers at the Mission gave these sea-weary British mariners a very warm welcome. Both sides were punctilious in their courtesies and fired salutes on every appropriate occasion. The only Spanish piece of ordnance, however, to protect the Bay of San Francisco and to salute visitors was a brass cannon lashed to a log of wood close to the south end of where now the great two and a half mile Golden Gate bridge loftily crosses the narrows. Here Menzies probably found *Lupinus arboreus* described by Sims in 1803 but without locality. The fresh meat and vegetables provided in

generous quantities soon cured the scurvy which had appeared. After a horse expedition of 40 miles to Santa Clara, the ships sailed south and found Quadra awaiting them at Monterey. There Menzies saw *Pinus radiata* and *Cupressus macrocarpa* for the first time and was also the first botanist to gather *Sequoia sempervirens*, the most distinguished of all the trees of the coast. A specimen in the British Museum is backed 'Santa Cruz Menzies'. Strangely his Journal does not mention this wonderful discovery and we do not know if it was on this occasion, in November 1792, or on one of his two subsequent visits that he found this tree. At South Kensington there is also a specimen of *Arctostaphylos tomentosa* first found by Menzies at Monterey. As Jepson shows, this shrub for a full century has been attributed to 'Northwest America', where the species does not occur. What Menzies had found in the Puget Sound country on 4 May, and which he then records as 'a new species of *Arbutus* with glaucous leaves that grow bushy and 8 to 10 feet high' was not the *A. tomentosa* but *A. columbiana* Piper.

The vessels remained at Monterey from 26 November 1792 till 14 January 1793 when Menzies made an extensive herbarium collection in that delectable region; it is a pity his visit had not been three months later. The Admiralty Store ship 'Daedalus' had joined them at Nootka, sent out from England by way of Cape Horn. Her Commander, Lieut. Hergest, and Mr. Wm. Gooch had been murdered on the voyage out when calling at the Sandwich Islands. It was an especial disaster to Vancouver, as Gooch was an astromoner, well skilled in meteorological observations, and was to have joined the 'Discovery'. The ship brought letters from Banks. Vancouver shipped on the 'Daedalus' from California, bulls, cows, rams and ewes 'for the service of His Majesty's infant colony of New South Wales.' Señor Quadra refused payment in any form for these. Both Menzies and Vancouver make frequent references to the oaks they found in the north and in California as well as what they called holly-leaved oaks. *Quercus Garryana* in the north and *Q. lobata* were undoubtedly the two deciduous species they must have seen and *Q. agrifolia*, which was the '*Q. coccifera*' of Menzies. The ships' carpenters were glad of the timbers of all of them. Unfortunately, the herbarium plants of Menzies are now out of London for safe keeping, and therefore unavailable to me for the purposes of this paper.

I am indebted to Dr. Ramsbottom for the privilege of seeing letters from Menzies in the Banksian correspondence; also to our President for those at Kew. I have had copies made of the most interesting of them which I have sent to the Archivist of Victoria, B.C., to be placed with the Transcript of the Journal already there.

One of the most important of these is the long one written on 1 & 14 January 1793 to Sir Joseph from the 'Discovery' while at Monterey before the two vessels sailed for their second visit to Hawaii. He describes in much detail the course of the voyage from England and gives accounts of the visits to New Holland, New Zealand, Tahiti and Hawaii. He also informs Sir Joseph of their naming of King George's Sound in New Holland which they had thoroughly explored and he dutifully reports 'making a copious collection particularly of the genus *Banksia* which were there very numerous'. He tells that they had reached Owhyhee on 1 March

which the ships had left on 16 March, and had sighted New Albion on 17 April. This letter provides an historic document of North-West Pacific Coast exploration of only less value than the Journal itself or of Vancouver's own meticulous account in his 'Voyages'. Menzies gives in it a graphic summarized story of the exploration of the Straits of Juan de Fuca and the Gulph [*sic*] of Georgia and subsequent voyage to California.

The time at my disposal, as well as the patience of Fellows, will not permit of my describing except briefly the further course of Menzies' long voyages. The 'Discovery' uneventfully reached Hawaii from Monterey in a month and Menzies was able to do two botanizing trips before sailing again at the end of March for Nootka. He deplored the time of this visit to the islands when plants bore no fruit or flowers. Before sailing from the Islands they had landed in the bay where fourteen years earlier Captain Cook had been murdered.

On the North-West American Coast the exploration continued from Nootka as far as latitude 56 in the neighbourhood of Wrangel, Alaska, where in after years the Russians had a trading port and since then has been but little visited except by trappers, placer-miners and sportsmen. Menzies found the rivers crowded with salmon of several species, as they still are.

The explorations in the North during the summer added little to Menzies' herbarium. On one occasion a fracas with Indians nearly ended in disaster for one boat's crew. Landings were frequent to make Spruce beer, for which the most suitable conifer was the Western Hemlock, and Labrador tea from *Ledum palustre* was also an effective anti-scorbutic. On one occasion Menzies had the delightful and now impossible experience of coming on a shoal of sea-otters of several hundreds basking on the surface with their young. They met with the small British ship 'Butterworth' which sailed for China with 3,000 skins of this confiding and easily destroyed animal. In his subsequent paper he says that they were sometimes seen even 100 leagues out at sea. The exploration of the narrow channels between islands and interminable inlets was an arduous matter in the almost incessant rains that prevailed all summer long, and the ships' companies were glad to sail south, where they looked forward to the fleshpots of California.

By the autumn the vessels were back at Nootka and left once more for San Francisco. On 19 October the 'Discovery' entered the Bay, soon followed by the 'Chatham', to which Menzies had been temporarily transferred, and which had made a landing to explore what was probably the bay where the Klamath River debouches; this is the land of the Lawson cypress now grown everywhere in Britain which, however, Menzies does not mention, and little botanical work was effected owing to continuous fog.

At San Francisco and Monterey their reception in 1793 was a very different one from that of the previous year. A new Governor-General of the Province was in command, and his orders to the Commandant at San Francisco was to show no friendliness and give no help to the British. The store-ship 'Daedalus' again joined them from across the Pacific. She brought supplies for both ships, and for Menzies a long and historically most interesting letter from his friend, W. Patterson, a naturalist who had

been sent out to Port Jackson and which told much and graphically of the extraordinary events in France which had happened since Menzies had sailed from home. This letter he preserved all his life and it was among the papers I became possessed of.

After frigid courtesies at Monterey they set sail for Santa Barbara. There the Officer in charge at the Presidio and the good fathers of the Mission gave them a great welcome and plied them with 'refreshments' in the form of beef, mutton, poultry and vegetables. Menzies rode inland and collected some plants but in November there were, of course, no flowers. They continued the exploration of the coast to the south of San Diego, as far as latitude 30, which is well inside the present day Mexican territory, thus completing a survey of 26 degrees of latitude, or about 1,800 miles. By the 8 January they were back at Hawaii for their last visit.

Menzies, and also Vancouver, have much to say of the elaborate system of taboo, which had such compelling influence on the Hawaiians and their chiefs that these observances and proscriptions set by the priests were utterly inviolable.

The Journal ends abruptly when Menzies completes a vivid account of his ascent of the volcanoes Wha-ra-rai and Mauna Loa. The summit of the latter he reached on 16 February 1794 and found to be 13,643 ft. altitude. Menzies concludes his description of the climb by saying he reached camp at 10 p.m. 'after the most persevering and hazardous struggle that can possibly be conceived.' His was the first ascent of the mountain. The second was made by another great Perthshire botanist, David Douglas, forty years later. Menzies published the account from his journal of the former of these ascents in Loudon's 'Magazine of Natural History,' Vols. 1 and 2, 1828 and 1829.

From this point our knowledge of the voyage is derived from the 5th and 6th volumes of 'Vancouver's Voyages.' The exploration of Cook's Inlet in the far North was a perilous matter but ended in proving that this was not a river as Cook had supposed. Many Russians were met with in their trading settlements up and down the Northern coast; their condition of life was of the utmost primitiveness. The vessels were in the vicinity of Mount St. Elias and were in Baering Bay, which Cook had reached fourteen years earlier. One great achievement had been accomplished of which Vancouver says:—'The principal object which His Majesty appears to have had in view in directing the undertaking of this voyage having at length been completed, I trust the precision with which the survey of North West America has been carried into effect, will remove every doubt, and set aside every opinion of a North West passage, or any water communication navigable for shipping existing between the North Pacific, and the interior of the American continent within the limits of our researches."

On reaching Nootka they learned that Quadra had died the previous year and also that no instructions had as yet arrived from Madrid and London as to the settlement of the dispute about the possession of the region.

At Monterey they had as hospitable a reception as on their first visit of 1792. On the long voyage home the 'Discovery' anchored at Valparaiso and had to undergo urgent repairs to spars and rigging. Vancouver

for once relaxes into a most entertaining account of the ninety miles ride that he with Menzies and four other officers took to the capital, 'St. Jago', as he spells it. They were received most hospitably by Don Ambrosia Higgins de Vallenar, an Irishman who was 'Captain General of the kingdom of Chile.' The story of Menzies taking from the luncheon table the seeds of pinõn—*Araucaria araucana*—and raising therefrom five plants on the voyage home is well known. It is authentic, as it was told to Elwes by Sir Joseph Hooker, who as a youth had it from Menzies' own lips when he was an old man. Of these trees I have a table made from the last of the five which had been planted out at Kew by Banks ; it died in 1892. William IV. when driving in his phaeton at Kew never failed to point out this strange tree to his friends.

Menzies addressed his last letter during the voyage to Banks from Valparaiso on 28 April 1795. In it he tells of landing at Cocos Island and of the innumerable seals, penguins and iguanas and other lizards of the Galapagos Islands.

The rest of the voyage home, via St. Helena, was without incident, but it must be mentioned that Menzies and Vancouver fell out towards the close of it ; the principal trouble appears to be Vancouver's demand for Menzies' Journal which he had refused and sealed up for Sir Joseph Banks's eyes. In a letter addressed to Banks from the Shannon on 14 September 1795 he acquainted him of the arrival of the 'Discovery' but reported that the Captain had actually put him under arrest since the 28 July owing to some disagreement about his countermanding of orders given by Menzies to his own servant by which many of the living plants in his glazed frame on the quarter deck perished. Vancouver must have been a man of violent temper, but after five years of close confinement in a ship of 330 tons the two men had clearly got on each other's nerves. I have wondered if Captain Vancouver had succeeded in appropriating the latter part of the Journal which ended so suddenly in February 1794. Vancouver, however, testified to Menzies' professional skill and botanical assiduity.

It is to be regretted that Menzies' Journal records so few of the localities of his botanical discoveries. This is especially true of the plants he gathered during the three visits to California. We would have preferred this information to the prolix daily account of the weather experienced and the nautical observations taken. As Jepson very justly says :—'At that time the importance of a strictly botanical journal with a numbering of specimens in sequence by stations, and dated as collected, was not appreciated.' Menzies' eighteenth century style is terse and descriptive with an extensive vocabulary ; from beginning to end the Journal contains no word of slang, a good example to many a modern diarist.

Few men have contributed so many new plants to our herbaria as Menzies. Dr. Newcombe, in his publication of the British Columbian portion of the Journal, gives a list of over 300 species (though a few names are synonymous) of his Pacific Coast plants. To twenty-five of these, and to nineteen from Hawaii Menzies' name has been given. The ericaceous genus *Menziesia* was dedicated to him by our Founder Sir J. E. Smith. The species, *M. ferruginea*, was collected by Menzies while with Captain Colnett and afterwards in the second voyage. Smith's words are 'to the

tireless traveller and botanist ' from whom he had received the specimens. Smith called him his much valued friend. In 1811 he added our Scottish *Menziesia coerulea* to the genus. In his Paradisus Londinensis, Salisbury, under *Menziesia globularis*, wrote ' it gives me no little satisfaction to describe a new Menziesia for one cannot be too frequently reminded of such a liberal botanist as it is named after.'

Arbutus Menziesii, first published by Pursh in 1814, has the historic interest of being almost the first tree of the Pacific Coast to be described.

Umbellularia californica was first collected by Menzies, but even before his time was known to the Spanish as ' Laurel sylvestre '. The British Museum sheet is backed ' New Georgia Mr. Menzies '. When I examined it over twenty years ago the foliage had its strong aromatic scent despite the 130 years that had elapsed since it was gathered. The greatest known spruce bore Menzies' name given to it by Lambert for long years and with many of my forestry compatriots still does so. Bongard the German had, however, called it *Pinus sitchensis* a year earlier. It is of interest to record that when I visited Castle Menzies with Sargent in 1908 we saw there the largest cultivated tree of it. We recalled that Menzies had worked there as a lad. One of the most curious and mysterious of Menzies' finds, gathered in 1787 on Queen Charlotte Island, and which the Indians smoked, was a species of *Nicotiana* which may be *N. nana* of Lindley, but which the veteran botanist of California, Miss Alice Eastwood, thinks may still be an unnamed species. Menzies was a good botanical draughtsman, and through the kindness of our President I am able to show photographs from Kew of his work. [Lantern-slides were shown of plates from Menzies' drawings of *Menyanthes Crista-galli*, *Parnassia fimbriata*, *Gentiana trichotoma* and *Abronia arenaria*; also, of a drawing of *Menziesia ferruginea* for the Bot. Mag. in 1813.]

Our Transactions show that he read a paper to the Society on 7 February 1797, on the ' Genus Polytrichum ' in which he described 19 species; the beautiful drawings are almost certainly by his hand.

Of the second half of Menzies' life there is meagre information available. He was given the Diploma of M.D. by the University of Aberdeen on 24 July 1799, presumably *honoris causa*, as he never studied there. Earlier in the same year he received a surgeon's commission to serve under Lord Hugh Seymour on H.M.S. ' Sans Pareil '. The Smith Papers in the hands of our Society include eleven letters from Menzies to our first President between 1805 and 1825. They are of no particular interest but indicate that these men were on intimate terms of friendship.

On retiring from the Navy he practised his profession in London, living in Chapel Place, Cavendish Square. In 1822 the University of Leipzig conferred its Diploma upon him. At some time when past middle life he married but had no child, and his wife predeceased him by six years when she died in 1836. From 1826 he lived at 2 Ladbrook Terrace, Notting Hill, and died there on 15 February 1842, aged eighty-eight. It was at that house that Douglas visited him after his return from the NW. Coast in 1827, and previously Scouler had brought him a letter from Douglas. Scouler must have had much to tell Menzies of what he had seen of the Indians and the plants of Nootka and the Columbia River where he had bidden farewell to Douglas a few months earlier. In the William Hooker correspon-

dence at Kew there are letters from Menzies which show the warm friendship which existed between the two men. They corresponded about Menzies' favourites Cryptogams, Gramineae, *Juncí* and Carices. In a letter of 27 January 1834 he expresses a great hope that Hooker will leave Glasgow to take the chair of botany at Oxford then vacant by the death of Dr. George Williams. In Asa Gray's letters in 1839 there is frequent mention of his meeting Menzies in his own house and those of friends. It was Hooker who published more of Menzies' plants than anyone before or since: his Botanical Miscellany begun in 1830 and his 'Flora Boreali-Americana' 1829-1840 are the chief sources of our knowledge of the Menzies discoveries. We can recall Douglas's excitement when he received the first part of this latter work before sailing on his second and last voyage to the Pacific Coast and again on receiving the second and third parts in 1832. Douglas, in his last letter to Hooker of 6 May 1834 from Hawaii, says that Archibald Menzies was still remembered by the natives as 'the Red faced man who cut off the limbs of men and gathered grass', a singularly appropriate description of a Scottish doctor with a taste for Gramine e.

Menzies was generous with his plants during his life and when he died bequeathed his large herbarium of cryptogams to the Edinburgh Botanic Garden. Many of his plants at the time of his death, other than those given long before to Banks, remained with his family till about 1871, when they were presented to the New College in Edinburgh for the use of the Natural History classes. These were acquired by exchange in 1886 by the British Museum from the Senatus of the University of Edinburgh. Some of his specimens from Oceania are reported to be in the Martius collection at Munich and his friend A. B. Lambert had others; these last are now in the British Museum. Menzies when he died had outlived his brothers and sisters, indeed, many of his nephews and nieces to whom he left his property were unknown to him. He was intimate, however, with one nephew, Charles Menzies, who was his principal executor. The latter survived his uncle for a short time only.

The graves of Menzies and his wife are in Kensal Green Cemetery, London.

APPENDIX.

Soho Square,
22nd February 1791.

Sir,

The business on which you are employed being of an extensive nature as it includes an investigation of the whole of the Natural History of the Countries you are to visit, as well as an enquiry into the present state & comparative degree of civilization of the inhabitants you will meet with, the utmost degree of diligence and perseverance on your part will be necessary, to enable you to do justice to your employers, and gain credit to yourself. The following instructions you will consider as a guide to the outline of your Conduct, but as many particulars will doubtless occur in the investigation of unknown Countries, that are not noticed in them, all such are left to your discretion and good sense, and you are hereby directed to act in them as you judge most likely to promote the interest of Science, and contribute to the increase of human knowledge.

In all places where the Ship in which you are embarked shall touch, and the Commander shall make a sufficient stay, you are to pay a particular regard to the nature of the soil, and to note down it's [*sic*] quality, whether Clay, Sand, Gravel, Loam &c., &c., and how it is circumsta nced in regard to water, you are to remark particularly the size of the Trees that gro w upon it, whether they stand in thick close Groves, or separate and distant from each other. You are to consider also, as far as you are

enabled to do by the productions, the probable Climate, and whether, should it at any time hereafter be deemed expedient to send out Settlers from England, the Grains, pulse, & fruits cultivated in Europe are likely to thrive, and if not, what kind of produce would in your opinion be the most suitable.

As far as you find yourself able, you are to enumerate all the Trees, Shrubs, Plants, Grasses, Ferns, and Mosses you shall meet with in each country you visit, by their scientific names, as well as those used in the language of the natives, noting particularly the places where each is found, especially those that are new or particularly curious; you are also to dry specimens of all such as you shall judge worthy of being brought home, particularly those of which you shall procure either living plants or Seeds, in order that the persons who are employed in examining the Plants you furnish to His Majesty's Gardens at Kew, may be assisted in ascertaining their names and qualities.

Whenever you meet with ripe seeds of plants, you are carefully to collect them, and having dried them properly, to put them up in paper packages, writing on the outside, or in a corresponding List, such particulars relative to the Soil and Climate where each was found, & the mode of culture in your opinion likely to succeed with it, as you may think necessary to be communicated to His Majesty's Gardeners, and you are to forward these packages directed to me for His Majesty's use by every convenient opportunity that shall occur, dividing them, for safety's sake, into Duplicates, as often as you shall judge needful.

When you meet with curious or valuable plants which you do not think likely to be propagated from Seeds in His Majesty's Garden, you are to dig up proper specimens of them, plant them in the glass Frame provided for that purpose, and use your utmost endeavours to preserve them alive 'till your return, and you are to consider every one of them, as well as all Seeds of Plants which you shall collect during the voyage, as wholly & entirely the property of His Majesty, and on no account whatever to part with any of them, or any Cuttings, Slips, or parts of any of them, for any purpose whatever but for His Majesty's use.

As soon as you shall have provided yourself with living Plants, and planted them in the glass frame beforementioned, you are at all times when the Ship shall be watered to acquaint the Commanding Officer what quantity of water you judge necessary for their support & preservation, by the week or month, in order that he may be enabled to make a competent provision of that Article for their future maintenance and nourishment.

In all your excursions on shore, you are to examine with care and attention the beds of Brooks, & Forrests, the steep sides of Cliffs & all other places where the interior strata of the earth are laid bare by water or otherwise, to remark the nature of the earth and stones of which they are composed, & if among them you discover ores, or metals, or any mineral substances which bear a resemblance to such things, or any beds of Coal, Lime stone or other matters, likely in your opinion to prove useful to mankind, you are to collect and preserve specimens of them carefully, noting the exact spot on which each was found; and you are also to examine the pebbles and sand brought down by the Rivers & Brooks from the inland Country, and to collect and bring home Samples of such as you suspect to contain mineral substances even though so minute as not to be discovereable but by a microscope.

At each place where you land, you are to inform yourself, as well as you are able, what sort of Beasts, Birds, and Fishes likely to prove useful, either for food or in commerce, are to be found, and pay particular attention to the various ways of catching them in traps or otherways used by the natives; you are to pay particular attention to every part of the natural history of the Sea Otter, and to learn all you are able concerning the wild Sheep said to be found in the inland Countries, and if in your power, to procure a skin of one of them for your employers, you are also to note particularly all places where Whales or Seals are found in abundance.

At all places where a friendly intercourse with the natives is established, you are to make diligent enquiry into their Manners, Customs, Language & Religion, & to obtain all the information in your power concerning their manufactures, particularly the art of dyeing, in which Savages have been frequently found to excell and if any part of their conduct, civil or religious, should appear to you so unreasonable as not to be likely to meet with credit when related in Europe, you are, if you can do it with safety and propriety, to make yourself an Eyewitness of it, in order that the fact of it's existence may be established on as firm a basis as the nature of the enquiry will permit.

You are to keep a regular Journal of all occurrences that happen in the execution of the several Duties you are entrusted to perform, & enter in it all the observations you shall make on every subject you are employed to investigate; which Journal, together with a compleat collection of Specimens of the Animals, vegetables & minerals you shall have obtained, as well as such curious Articles of the Cloths, Arms, implements and manufactures of the Indians as you shall deem worthy of particular notice, you are on your return to deliver to His Majesty's Secretary of State for the Home department, or to such person as he shall appoint to receive them from you.

I am
Sir
Your most obedient
humble Servant

Mr. Alexander [*sic*] Menzies. Jos: Banks

NEW RECONSTRUCTIONS OF THE WOOLLY RHINOCEROS AND MERCK'S RHINOCEROS.

By F. E. Zeuner, F.Z.S., F.G.S.

Four species of rhinoceros are known to have been contemporaries of Palaeolithic man in Europe. Three of them belong to the genus of the Recent Sumatran Rhinoceros (*Dicerorhinus sumatrensis* (Cuv.)). These are *D. etruscus* (Falc.), *D. merckii* (Jäger), and *D. hemitoechus* (Falc.), whilst the best known species, the Woolly Rhinoceros (*Tichorhinus antiquitatis* (Blum.)), is the descendant of a different group and presumably of Asiatic origin *. The last-named species has been reconstructed many times. Attempts of this kind were, no doubt, stimulated by the prehistoric drawings of this species. Of the other three, no drawings have yet been identified.

The Woolly Rhinoceros.

Of the numerous reconstructions of the Woolly Rhinoceros, only a few have been executed with sufficient care to face scientific criticism. Of these, Abel's reconstruction (1922, p. 30, fig. 30) is based on the cave-drawing from Font-de-Gaume (fig. 1), in which the neck is short and

Fig. 1.—*Tichorhinus antiquitatis*, cave drawing, probably Aurignacian, from Font-de-Gaume, Les Eyzies, Dordogne, France. From Capitan and Breuil, 1910.

* On the classification of the Pleistocene rhinoceroses of Europe, see Wüst (1922); that of the recent species, Lydekker (1916).

surmounted by a hump. The position of the head in this cave-drawing suggested to Abel an analogy with the Recent White Rhinoceros (*Ceratotherium simus* (Burchell)), of Africa, which is well characterized by the inclined carriage of the head (Zeuner, 1934 *c*, p. 35). Charles R. Knight's reconstruction (1935, pp. 92–93) agrees in these respects with Abel's; it is distinguished chiefly in details of the coat of hair. The reconstruction by Hilzheimer (1924) deviates in several important points, such as shortness of the body, skin-folds and curvatures of the horn; they will be referred to later. Stach's sketch (in Nowak *et al.*, 1930, pl. 9, fig. 1) is based on the second Starunia specimen to be described presently.

Several specimens of *T. antiquitatis* have been found preserved with skin and flesh. Those coming from the land-ice of Siberia unfortunately suffered much damage on their long journey to St. Petersburg, and few body features have remained available for study (Brandt, 1849; Schrenck, 1880 *). More ample information concerning the soft parts of the body was obtained from the fore half of a young specimen found embedded in petroliferous silt at Starunia in the Polish Carpathians (Niezabitowski, 1912: *Wykopaliska Starunskie*, 1914). Encouraged by this discovery, the Polish Academy of Sciences started systematic excavations after the last war, and was rewarded with a complete female specimen, which provides a sound basis for the reconstruction of the species (Nowak, *et al.*, 1930). Since little is known outside Poland about this find, a few notes on environment and preservation may precede here the description of the specimen.

Environment of the Woolly Rhinoceros at Starunia.—Starunia lies near Stanislawow, in the foothills of the Carpathians, which were folded at the end of the Miocene and have since been subject to erosion and denudation. In Pleistocene times it was almost 30–40 miles distant from the Carpathian glaciers, and about 80 miles from the edge of the greatest glaciation of the Ukraine. The silt which contained the body also yielded an abundant flora and insect fauna of distinctly subarctic type (Szafran, 1934; Gams, 1934; Zeuner, 1934 *b*; Szafer, in Nowak, *et al.*, 1930). The insects in particular have made it possible to determine climatic conditions with a certain degree of accuracy (Zeuner, 1937); the probable range of temperature was as follows:—

Above 0° C. April or May to October—6 to 7 months.
„ 3° C. May to September—5 months.
„ 6° C. June to September—4 months.
„ 9° C. June or July to August—2 to 3 months.
Highest monthly mean: July, 9°·9–11°·8 C.

The environment appears to have been one of alpine meadows with plenty of *Vaccinium*, dwarf birch, *Dryas octopetala*, and some shrubs like alpine willows and stunted spruce. The plant remains found associated with the second fossil body were definitely not of the forest

* The specific identity of this specimen is uncertain. It was described as *D. merckii*, but Abel (1922) assigned it to *T. antiquitatis*, and Wüst (1922) to *D. hemitoechus*.

type *, but rather characteristic of the alpine zone near the limit of tree-growth. It was mostly low-growing, a point of some importance as will be seen later on.

The valley, clad with this type of vegetation, was watered by a small river. In addition, there was a number of springs of saline water associated with outflows of oil. Both saline water and oil impregnated the silt deposits of the flood-plain of the river. Since salt and oil tend to prevent freezing, it is conceivable that such spots attracted many animals in winter, quite apart from the general attractiveness of salt for ungulates.

The preservation of the body of the rhinoceros, however, does not suggest that a saline oil spring acted as a natural trap after the manner of Rancho La Brea, in California.

Preservation of the second body.—It was found lying on its back, in a severely contracted attitude (fig. 2). The left side of the body had large

FIG. 2.—Plaster cast of the carcass of a female Woolly Rhinoceros found at Starunia near Stanislawow, exhibited in the Museum of the Polish Academy of Sciences, Cracow.

holes in the neck and the belly, and the internal parts were less well preserved than the skin and some of the muscles. Most of the intestines, and even some of the cervical vertebrae were missing, though some remnants of the former were found a few feet from the body. The cavity of the body was filled with silt. Stach (in Nowak, *et al.*, 1930) rightly emphasizes that some time must have elapsed after death,

* The flora and fauna found with the first body (1907) was temperate. The excavation of 1929, however, proved that the first body had been re-buried in an old shaft, presumably by peasants, together with modern refuse. Fauna and flora described in *Wykopaliska Starunskie*, therefore, should be regarded as suspect.

before the final embedding in petroliferous and saline silt took place. It may be inferred that the specimen died from an accident in winter, that at some time it was attacked by carrion-feeders, and that the frozen body was transported to the place of fossilization by the river in spring (Zeuner, 1934 *a*). When the body had been embedded in the silt, salt prevented further decomposition and the oil excluded the air. In the course of time, the water contents of the tissues were replaced by oil, and shrinkage of the muscles resulted in the fragmentation of most of the bones. The hair lost its cohesion with the follicles in the skin, so that it remained in the silt when the excavators removed the body. The preparation of the skin for exhibition was a truly monumental task, and was carried out with the greatest skill and perseverance. Fig. 3 shows the specimen as it now appears in the Museum of the Polish Academy of Sciences in Cracow.

Sex, age and size.—The specimen is a female, full-grown or almost full-grown. Some of the differences which it exhibits in comparison with the Palaeolithic drawing from Font-de-Gaume, are probably due to its sex and comparative youth, since Stone Age draughtsmen are more likely to have chosen old bulls than young cows as their subjects. The skin, from the nose to the root of the tail, was 358 cm. long, to which 51 cm. have to be added for the tail.

This specimen has provided us with many morphological details and thus made it possible to settle disputed points. In the following paragraphs only those features are mentioned which have some bearing on the reconstruction. For others, and for a fuller description, the reader is referred to Stach (in Nowak, *et al.*, 1930).

Mouth.—The Font-de-Gaume drawing (fig. 1) shows a curiously short lower lip. Hilzheimer (1924) based far-reaching conclusions on this apparent feature of the Woolly Rhinoceros and thought that the species lived like the elk (*Alces alces*) in forests. In the Starunia female, however, the upper lip protrudes only moderately over the lower. Yet, Hilzheimer's interpretation, which is in part derived from the Font-de-Gaume drawing and in part from the relative shortness of the lower jaw, need not be entirely without foundation. It is conceivable that the strongly protruding upper lip was a character of old bulls which carried heavy horns and whose horn-base on the nasalia was correspondingly strong and large, pushing the upper lip into an extreme proximal position.

Both upper and lower lips of the Starunia female were straight, and the snout resembled that of the Recent White Rhinoceros. The pointed, prehensile extension of the upper lip of the other Recent species was absent. Now, the White Rhinoceros is the only living steppe species, and a straight-lipped mouth is well adapted to grass-feeding, whilst the prehensile upper lip serves for seizing twigs and foliage. The structure of the snout, therefore, renders it probable that *Tichorhinus* was a grass-feeder and not a woodland form.

Eye.—The eye lies 44·5 cm. from the tip of the nose and 21 cm. from the root of the ear. The opening measures only 4 cm. across. In view of the small scale of our reconstruction, details are of no importance, though it may be mentioned that even the smallest folds of the eye region were preserved.

Ear.—Only the right ear was preserved. It was damaged and had suffered from shrinkage. It was 24 cm. long, elliptical and apparently somewhat more slender than that of *C. simus*. Its exact shape is still uncertain.

Horns.—The horns of the Starunia female were missing, they were apparently dissolved by the oil in the silt. The specimen of 1907 had remnants of the horns in an obvious state of partial solution. From their size, considering the extreme youth of this specimen, it may be inferred that especially the nasal horn grew very rapidly. The Starunia female, therefore, may be supposed to have carried large horns, although it was not an old individual. The reconstructed horns given to it by the Cracow Museum authorities (fig. 3) conform to this view. In our re-

FIG. 3.—Mounted specimen. Polish Academy of Sciences, Cracow. Horns added.

construction, curvature and shape were taken from Siberian horns, of which a number are contained in the British Museum collection. Others were figured by Brandt (1880). In Hilzheimer's reconstruction, the upper third of the nasal horn is strongly curved backwards, as it often is in the much smaller Sumatran Rhinoceros. But, though fossil horns of *T. antiquitatis* from Siberia vary in shape, most have an even curvature which, therefore, has been adopted in the present reconstruction.

The base of the nasal horn is as much as 27 cm. long and 19·4 cm. wide. It is situated more proximally than in any of the Recent species, including *C. simus*. Thus, the horn must have slanted forwards considerably, as, indeed, is shown in the Font-de-Gaume and other drawings. The base of the second horn begins only 4 cm. behind the nasal one and is 19 cm. long and 16 cm. wide.

Neck-hump.—The Font-de-Gaume drawing shows a most pronounced hump on the neck, and the neck, as a whole, is relatively short. In both respects the Starunia female differs from the cave drawings.

The Font-de-Gaume drawing shows a single large hump extending from the shoulder-blade to the occiput. But Hilzheimer (1924), relying on the Recent African species, considered it more probable that a hump on the neck was separated from the usual eminence of the withers. A separate neck-hump is a conspicuous feature of bulls of the White Rhinoceros (see, for instance, photograph by P. C. R. Senhouse, in Zeuner, 1934 *c*, pl. 3, fig. 7). It may be sufficiently large to obscure to some extent the convexity of the withers. Admitting the same for bulls of *Tichorhinus*, the large hump shown in the Font-de-Gaume and other drawings may be regarded as a sexual character.

In the female from Starunia there is no conspicuous hump. Instead, four eminences, or minor humpings, are distinguished by Stach (compare fig. 3). The last, or hind-most, of these is the suprascapular eminence. The two nearest to the occiput may be regarded as strong skin-folds. The third, in front of the withers, is by far the largest and probably the equivalent of the large hump of the Font-de-Gaume drawing. Owing to the damaged condition of the neck, Stach was unable to ascertain whether fat tissue was contained in these folds.

The neck of the Starunia female appears long for a rhinoceros, partly because the large hump is absent (this makes it look more slender) and partly because it is stretched, the head being bent down, as in the act of grazing. Whether the neck was longer than shown in the Font-de-Gaume drawing if measured in relation to the head or body is difficult to decide, since one has to make some allowance for inaccuracy of proportions in the cave drawings.

Average carriage of the head.—In the mounted specimen the bent position of the head was retained, and the same has been done in the present reconstruction in order to follow the fossil specimen as closely as possible. The question of the average carriage of the head, therefore, does not arise in this particular reconstruction, though if we want to have an idea of how the Woolly Rhinoceros looked when standing quietly at ease (dozing in this position is a favoured habit of rhinoceroses), it is necessary to derive the average carriage of the head from the angular proportions of the skull and to compare the result of such analysis with the Palaeolithic drawings. This method will be described later, under *D. merckii* (p. 192), so that it suffices here to summarize the conclusions. *Tichorhinus* carried its head at a moderate angle, much like the living Black Rhinoceros (*Diceros bicornis* (L.)). This attitude is shown in a drawing of a couple of Woolly Rhinoceroses on a piece of slate from the Grotte des Trilobites (Yonne, Central France). The Font-de-Gaume drawing shows a steeper angle, which, of course, may well have been assumed, especially by specimens carrying large horns or in the posture of defence. But the reconstructions by Abel, Knight and Hilzheimer show the head at too steep an angle, a feature which was taken from the White Rhinoceros.

Body.—Owing to shrinkage the ribs showed through the skin of the carcass. But the right-hand side of the body was so well preserved that no doubt remained about the complete absence of skin-folds, which are so characteristic of some of the Recent species. Hilzheimer, therefore, was mistaken in giving skin-folds to *Tichorhinus*.

The profile of the back shows both the lumbar and the sacral eminences which are so typical of rhinoceroses. The lumbar eminence is due to the high spinous processes of the lumbar vertebrae. Stach pointed out that Hilzheimer, in his reconstruction, placed the lumbar eminence too much forward, and that the body, as a whole, was appreciably longer than shown by him.

The lumbar and sacral eminences are hardly recognizable in the Font-de-Gaume drawing. I am inclined to think that they were obscured by the hair so conspicuously sketched on the back by the draughtsman of Font-de-Gaume.

Tail.—The tail is broad at the base, and the basal two-thirds are flattened, while the terminal third is circular. The tail acted as a lid for anus and vagina. Stach (in Nowak, *et al.*, 1930, p. 38) observed that the top and the sides were covered with hair, short near the base, longer towards the apex. 'The longest hair appeared however probably along the side edges of the tail, which caused the shaping of a sort of flat, fan-like tuft'. Thus, the tail appears to have differed from those of Recent rhinoceroses living in hot climates.

Legs.—The legs resemble those of the White Rhinoceros. There were no skin-folds. The hoofs had disappeared, presumably they were dissolved, but their positions were readily determined from the clearly preserved edges.

The Hair.—The coat of hair still presents some problems. *Tichorhinus* is commonly believed to have been woolly. This notion was in vogue already in the sixties of the last century, and therefore must have been derived from the only preserved carcass then known, that from the Wilui River (Eastern Siberia), of which the head, one fore-foot and one hind-foot were obtained by Pallas in 1773, dried in an oven and sent to St. Petersburg. Symonds (1868) says that *Tichorhinus* was protected 'by long wool and hair'. This pronouncement was objected to by Brandt (1870), who had studied the specimen in question. He pointed out that there was no wool, but only one kind of coarse, blackish hair which grew densely in tufts of about twenty, and was never more than about 1½ ins. long. But it is unlikely that Brandt ever saw the hair-coat of the body.

The Font-de-Gaume drawing shows a beard as well as a kind of mane, or at least denser hair on the back of the neck. The presence of the latter is confirmed by the Starunia female. Whether this mane was stiff and erect (as in the wild horse), or falling over (as in the domesticated horse), is not clear. Either interpretation can be derived from the drawing. In our reconstruction the second view is expressed, relying on the three or four long streaks of hair on the neck, and regarding the four thick, short lines of the ear region as hair falling over the forehead. But it must be remembered that the alternative of a stiff mane, as expressed by Knight, may well be deduced from the thickening and blurring of the outline of the neck as it approaches the head.

The coat of the body also has to be deduced from the Font-de-Gaume drawing. The hair found in the silt which surrounded the Starunia female is described as 'light and fine, tangled and gathered into small tufts, among which one finds occasionally darker and coarser hairs'

(Stach, in Nowak, *et al.*, 1930, p. 24). But its length is not given. Now the streaks which indicate the hair on the Font-de-Gaume drawing are remarkably long, and whatever they may represent otherwise, they cannot be reconciled with the view that the hair was short. It rather appears to have been long, growing in locks or tufts which fell over the body and partly concealed the outlines of the latter.

The tail had no tassel of coarse hair arranged in the plane of symmetry of the animal, but the longest hair appears to have grown on its sides (see above). The tail in the Font-de-Gaume drawing is in keeping with this view.

Thus, the new reconstruction (fig. 4) attempts to give an impression of a female specimen of moderate size, not of a strong bull (which has

Fig. 4.—Reconstruction of the Woolly Rhinoceros, representing a young female, based on the Starunia specimen, by the author. British Museum (Natural History).

been aimed at in earlier reconstructions). It adheres closely to the data derived from the second Starunia specimen, except for the horns and the hair. Other individuals of *Tichorhinus* are bound to have been larger, and the bulls in particular are likely to have differed in the possession of a large neck-hump.

Merck's Rhinoceros.

Merck's Rhinoceros was the temperate counterpart of the Woolly Rhinoceros in the Upper Pleistocene. It has not been found in deposits of a thoroughly cold climate and is most frequent in deposits of a decidedly temperate character, especially those which are slightly warmer than the present. It is highly probable that the form called *Rhinoceros megarhinus* in Britain is synonymous with *Dicerorhinus merckii* (Jaeger) *. The lineage of this species appears to go back to the Pliocene, the ancestral

* This was suggested by Falconer (1868, vol. II, p. 398), who identified teeth from Grays Thurrock with Jaeger's type specimens from Kirchberg. This view was subsequently established by Schroeder (1903, p. 92 ff.).

form being *D. etruscus* (Falc.), which is generally regarded as a distinct species. In the middle and upper Pleistocene, *Dicerorhinus hemitoechus* (Falc.) occurs, but of this species we can say no more at present than that it was probably a grassland form, both of temperate and cool climates.

The attempt to reconstruct *D. merckii* (fig. 5) has to be based on much scantier material than was available for *T. antiquitatis*. There are no Palaeolithic drawings, and not even a complete skeleton. A skeleton is available, however, of the ancestral form, *D. etruscus* (Toula, 1902). Fortunately, skulls and portions of skulls are comparatively numerous; eighteen of *D. etruscus* and six of *D. merckii* have been studied by the present author.

Objections may be raised to using material of *D. etruscus* in this context. I should point out, therefore, that this earlier form has merely been consulted in order to establish which characters are common to it and *D. merckii*. Apart from the known differences in the dentition, no clear-cut differences have been found in the skull. The alleged absence

FIG. 5.—Reconstruction of *Dicerorhinus merckii*, by the author. British Museum (Natural History).

of the nasal septum in *D. merckii* is a myth. The septum is quite often present, but Wüst (1922) found, and my material completely confirmed it, that the fusion of the septum with the nasalia did not take place until the individual had reached a considerable age. It is possible that in *D. etruscus* the fusion occurred a little earlier, so that evidence for it is found on the underside of the nasalia in *D. etruscus* more often than in *D. merckii*. Had the nasal septum been absent in *D. merckii*, one might have been justified in inferring a very weak development of the horns. Even in the Recent *D. sumatrensis* some ossification of the septum may be observed, although the horns are small. The larger septum of *D. merckii* would suggest correspondingly larger horns. On the other hand, the nasalia of this species are narrower than those of *Tichorhinus*. This limits the size of the anterior horn base and therefore of the horn also.

In the reconstruction, these points have been borne in mind, while the shape of the horns has been taken from *D. sumatrensis*.

Another supposed difference between *D. merckii* and *etruscus* is the angle between the plane of the horn-bases and the portion of the cranium rising to the occipital crest. Forsyth Major (1874, p. 113) considers it as very flat, approaching 180° in *D. etruscus* and much steeper in *D. merckii* (Major says *D. hemitoechus*, but Schroeder, 1903, p. 11, takes this to mean *D. merckii*). Apart from the ambiguity introduced by the existence of the third species, *D. hemitoechus* (often misidentified), it is possible that this angle *is* flatter in Pliocene specimens of *etruscus*. My own measurements, which included only three Pliocene specimens, did not confirm it. The extreme values and the mean of *etruscus* and *merckii* are almost identical, though it should be noted that nine out of twelve specimens of *D. etruscus* were Lower Pleistocene. This, together with other measurements of angles, suggests that there was little, if any, difference in the outlines of the skulls of Pleistocene *D. etruscus* and *D. merckii*.

It is possible that the nasal horn-base was somewhat wider in Pleistocene *etruscus* specimens than in *D. merckii* (Zeuner, 1934 *c*, p. 68). If confirmed on more ample material, this character would be corroborated by the earlier ossification of the nasal septum in *D. etruscus*, indicating that in this species the nasal horn was larger.

It was Toula (1902) who first recognized and carefully established the close relationship of *D. etruscus* with both *D. megarhinus*=*merckii* and with the Recent *D. sumatrensis*. Osborn (1900) already regarded this living species as the most primitive of all. It is a forest form with many peculiar characters which separate it from the other modern two-horned species. As *D. merckii* has proved to be congeneric with *D. sumatrensis* on osteological evidence, it may justly be claimed to have resembled this living species more closely than any other, except, of course, in features which osteological evidence shows to have differed. This, at least, provides a tentative basis for the reconstruction. The following characters have been assigned to *D. merckii* on the ground of its close affinity to the Recent *D. sumatrensis* :—Proportions of body, outline of the back, folds of the skin, skin structure, hairiness, shape of ears.

In agreement with the Sumatran Rhinoceros, the neck-hump is assumed to have been absent in *D. merckii*, though it is conceivable that a slight hump, or thickening, was present as, for instance, in the Black Rhinoceros. Conspicuous skin-plates edged by deep folds cover the humeri and femora. The upper lip is assumed to have been of the pointed type possessed by all Recent species except the pure grass-feeder, *C. simus*.

Average carriage of head.—In rhinoceroses the average carriage of the head determines to a large extent the appearance of a species. It varies greatly in accordance with feeding habits, as has been shown by means of a semi-statistical treatment of the Recent species, based on measurements of angles defining the positions of the facial part of the skull and the cranium, relative to each other and to the occipital foramen (Zeuner, 1934 *c*). This analysis of over 200 skulls is summarized in fig. 6. It shows the outlines of skulls, all arranged on the vertical axis of the occipital foramen. The dotted lines in *a*, *b* and *c* represent *Diceros*

bicornis, the Black Rhinoceros, which is a denizen of the bush-steppe feeding on leaves as well as on grass. In fig. 6 *a*, *Rhinoceros unicornis* L. is shown, a virgin forest species which feeds exclusively on foliage. In

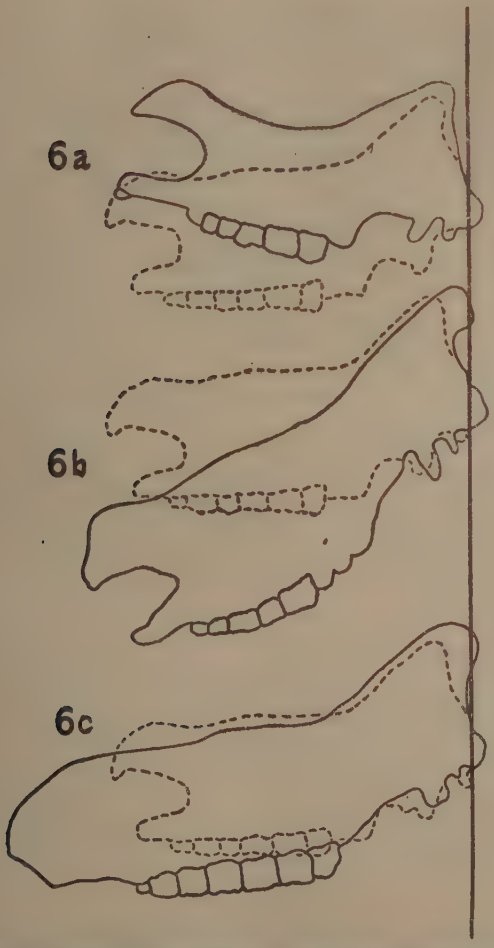

FIG. 6.—Outlines of skulls of rhinoceroses, all arranged on the vertical axis of the occipital foramen. Dotted line: *Diceros bicornis*. 6 A: *Rhinoceros unicornis*. 6 *b*: *Ceratotherium simus*. 6 *c*: *Tichorhinus antiquitatis*.

accordance with this habit the facial portion of the skull is raised. In contrast to this condition the pure steppe species, *Ceratotherium simus* (fig. 6 *b*), has a greatly lowered face; its skull is, so to speak, stretched

towards the source of the food *. Thus, the rhinoceroses of the forests are found to have their heads pointing more or less forwards, those of the bush-steppe somewhat inclined downwards, and those of the grass-steppe strongly so. There is sufficient evidence for this rule to be regarded as generally applicable. It allows us to argue from the Recent forms to the fossil ones, to obtain information about their way of carrying the head, and incidentally about the environment in which they were living.

As to the Woolly Rhinoceros, we meet with a very peculiar combination of angular proportions in the skull. As shown in fig. 6 *c*, the amount of downward bending of the face is moderate. It is higher than in the bush-steppe species, *D. bicornis*, yet less extreme than in the steppe species, *C. simus*. But an inspection of the angles between the palate and the occipital plane, between the palate and the vertical axis of the occipital foramen, and between the occipital plane and the parietal plane of the forehead reveals that the skull was adapted to a severe stretching of the neck. Head and neck appear to have been brought into a line in the process of feeding, and the food must have been very low-growing. When in the position of rest the head of *Tichorhinus* may have formed with the body an angle only slightly steeper than seen in the Black Rhinoceros, though the great length of its skull would have made it look very different.

As to Merck's Rhinoceros, all angles prove to be similar to those of the Black Rhinoceros. From this it may be inferred that the average carriage of the head was much the same as in this Recent species, and this feature has been expressed in our reconstruction. *D. etruscus* agrees in this respect entirely with *D. merckii*, though both differ in certain other respects from the Recent *D. sumatrensis* (see Zeuner, 1934 *c*, pp. 32 and 59).

The hair.—The Sumatran Rhinoceros is the only living one possessing an appreciable amount of hair all over the body. It is admittedly loose, like a haze over the skin, but in view of the tropical forest habitat of the species, its presence is most readily interpreted as an ancestral character. It is highly probable, therefore, that its congener, *D. merckii*, considering the rougher climate in which it lived, was equipped with a fairly dense coat of hair. How long and how conspicuous it was cannot be ascertained. In the reconstruction a moderate and relatively short coat of hair has been indicated.

The tail of *D. sumatrensis* has a laterally compressed tassel, and the same has been given to *D. merckii*.

Conclusion.

These two models of rhinoceroses are the second couple of a series made by the present author with the assistance of Miss I. Gedye of the University of London Institute of Archaeology (see Proc. Linn. Soc. CLV. p. 245). Their scale is half-an-inch to the foot, or 1/24th of natural size. They have been acquired by the British Museum (Natural History), where they are exhibited in the Geological Department.

* Dr. F. C. Fraser kindly informs me that an exhibit in the British Museum (Natural History) demonstrating similar, but very slight differences in the horses, was in all probability constructed by Lydekker. It is now kept in the Osteological Room.

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PROCEEDINGS OF THE GENERAL MEETING
22 June 1944.

Mr. A. D. Cotton, O.B.E., President,
in the Chair.

The Proceedings of the General Meeting held on Thursday, 8 June 1944, having been circulated, were taken as read and confirmed.

The following Fellows signed the Obligation in the Book of the Charter and Bye-Laws and were admitted :—Dr. Ethelwynn Trewavas and Mr. Douglas Charles Harrod.

The President announced that the General Meeting of 6 July would not be held because two of the principal papers arranged for that Meeting had been withdrawn.

The following communications were read and discussed :—

Mr. K. N. Kaul. A fossil palm stem from South Africa (*Palmoxylon Du Toitii*, sp. nov.). (Discussed by the President.) [Printed below.]

Mr. R. Clements. On the vegetation of the Sierra Nevada de Santa Marta. (Discussed by Dr. B. Barnes, Dr. F. R. Irvine and the President ; Mr. Clements replied.)

Abstract.—

The paper gave geological and geographical notes on the Sierra Nevada de Santa Marta, an isolated mountain mass, bearing snow peaks and glaciers, in the tropical north-eastern part of Columbia, South America. Details of the different vegetation zones which correspond with altitudinal zones were given. The relative paucity of the flora, which includes many indigenous species, was commented upon, together with its probable relation to the isolation of these mountains by a hot tropical plain. Climatic changes which are tending to make a desert of the tropical plains were mentioned.

The late Prof. H. B. Fantham and Dr. Annie Porter. On a Plasmodian (*P. relictum*) observed in four species of Penguin. (Discussed by Dr. G. Carmichael Low and Dr. E. Hindle, F.R.S. ; Dr. Porter replied.) [This paper will be published by the Zoological Society.]

A FOSSIL PALM STEM FROM SOUTH AFRICA (PALMOXYLON DU TOITII), SP. NOV.

By K. N. Kaul.

The species described here is represented by a mounted section $\frac{V}{21476}$ in the British Museum (Natural History). It is out of a large collection of palmwood material from different parts of the world which Mr. W. N. Edwards, the Keeper of the Geological Department, has very kindly allowed me to investigate and which I propose to discuss in a series of papers; this being the second in the series.

Material.—The colour of the material is very light rusty brown. The fibro-vascular bundles have taken more brown colour during petrification. Preservation is good but only the central part of the stem is represented.

Locality; geological horizon: age.—The slide was presented by A. L. du Toit, who has described the locality as quaternary diamantiferous gravels of Vaal river below Barkly West, South Africa. Regarding the age of the

Fig. 1.—A few fibrovascular bundles. All × 16.

gravels he has remarked thus in 'The Geology of South Africa' 1926: 405: 'It seems likely that the oldest of these deposits will date back into the Tertiary for they may be hundreds of feet above the present river channels (400 feet in those about Klipdam in Barkly West . . .).'

Description:—In the transverse section a large number of scattered fibro-vascular bundles with irregular orientation are seen in a well preserved compact ground-tissue of spherical cells. Distribution of the fibrovascular bundles is thirty-one per square centimetre. The form of the bundles varies from orbicular to reniform. With a few exceptions all the bundles are of uniform size and diameter. No purely fibrous bundles are present. In typical bundles there are two vessels, which lie side by side, completely excluded or in a few partially included in the arms of the sclerenchyma. The arms of the sclerenchyma are round and the median sinus concave. The general ground-tissue is compact and consists of small thin-walled isodiametric cells, which here and there show very small interspaces, and then the cell wall appears slightly sinuous. There is no well-defined layer of parenchyma over the vascular part, except sometimes over the pro-

jecting vascular region of the leaf-traces. Leaf-traces are very few. They do not show any character of importance.

Discussion.—In the absence of the dermal and the subdermal zones I have not attempted to give a natural position to the species but following the old practice have created a new artificial one.

Considering the size of the central part preserved, the original stem with the dermal and the subdermal zones intact must have had a good girth. In its anatomical structure it shows affinities in its fibrovascular bundles and in the ground-tissue with the modern generic group *Hyphaene*. But the data at present available do not allow us to discuss it further.

FIG. 2.—Distribution of Palms (Tropical) in Cretaceous (*c*); Tertiary (Black areas); Modern (between AA′ BB′); but the occurrence of fossils between 0–0 suggests temperate climate.

The discovery of a Tertiary palm so far south (a little further west of the modern palm-line in the southern hemisphere) in Africa is of great importance. In the first place, it indicates that the climate of South Africa has not changed since that time; and, secondly, that the equator was not very remote which the theory of the shifting of the poles pre-supposes. On the contrary, the distribution of the palms in the Cretaceous and Tertiary as shown in the map clearly indicates that throughout this time and later the tropical zones and the equator must have remained unchanged. The changes in the climate of Europe must be due to other causes purely local in character and not a world-wide one as shifting of the poles, since the extra-European areas of the world do not show any change in the character of vegetation since the Tertiary.

I take this opportunity to thank the Keeper, Mr. Cotton, for giving me facilities in the Kew Herbarium to do this work.

OBITUARIES.

EDWARD CHARLES STUART BAKER died on 16 April at his home in Upper Norwood at the age of seventy-nine. He was educated at Trinity College, Stratford-on-Avon and, following in his father's footsteps, he joined the Indian Police in 1893. He first served in Bengal, and later was transferred to Assam, where he spent the remainder of his service.

At the beginning of his service many parts of Assam were comparatively little known, and he was one of the first to explore and write on the birds of the Cachar Hills. Fortunately for him—with his interest in ornithology—most of his service was spent amongst the hilly tracts where the birds were little known, more especially as regards their nesting habits. Early in his career he developed a great interest in eggs, and before long was corresponding and exchanging specimens with all the principal collectors in the Indian region. He described the eggs and nests of many unknown Indian species and, after his retirement, published a comprehensive work on the nidification of Indian birds.

Apart from the general collecting of eggs, Baker made a special study of the eggs of the Cuckoo and, by his own efforts and the help of correspondents, amassed a huge collection of the eggs of different Indian species and their fosterers, amounting to some 6,000 eggs of the cuckoos alone. This collection was acquired by the Trustees after his death. Some years previously he had presented to the British Museum his general collection of eggs, some 49,360 specimens belonging to 1,960 forms. In 1942 he published 'Cuckoo Problems', the result of his life-long study of Indian Cuckoos and their eggs.

For many years Baker was considered the leading authority on Indian birds and contributed many papers to the 'Journal of the Bombay Natural History Society' and the 'Ibis'. His articles on Ducks and Game Birds in the former journal, which were afterwards republished in book form, made his name a household word amongst sportsmen and bird lovers in India. It was, therefore, only natural when someone was wanted to write a new edition of the Bird volumes in the 'Fauna of British India' Baker should have been asked. Much information had accumulated since the original volumes were published, and he found it necessary to expand into eight volumes for the new edition. This work is now the standard authority on Indian birds.

Besides his great interest in ornithology Baker was a keen sportsman and well-known as a big game hunter, contributing many articles to different periodicals on the habits of the larger animals of Assam. In spite of the fact that he lost one arm in an encounter with a panther, Baker was a good shot, a keen tennis player, and able to write very clearly on the smallest bird's egg.

In 1908 he became Inspector of Police for Eastern Bengal, and on his retirement in 1911 was appointed in charge of the Port of London Police. This force he re-organized and brought to a high state of efficiency, and in 1925 he retired.

After his retirement he joined the Croydon Municipal Council and served as Mayor for the year 1938–39, continuing to sit on the Council

until 1942. Baker was Honorary Secretary and Treasurer for the British Ornithologists' Union from 1913 to 1936. He was awarded the C.I.E. in 1932 for services in India, and the O.B.E. for his work during the war. He was elected a Fellow of the Linnean Society in 1908.

He married in 1897 Ethel Mary Roffrey, who survives him, together with four daughters. N. B. Kinnear.

Frederick Chapman was born in Camden Town on 13 February 1864, and died at his residence at Kew, Victoria, on 10 December 1943, in his eightieth year. He was the second son of Robert Chapman, who was assistant first to Michael Faraday and later to John Tyndall, while his elder brother, also named Robert, was a physicist with interests in microscopy and botany. In these surroundings he early became attracted to science, with entomology and botany claiming his special attention. After his early education, much of which was given by an older sister, he hoped to secure a cadetship at the British Museum, but was disappointed in this and obtained employment for a short time as a clerk in a railway company. At the age of eighteen he was appointed laboratory assistant to Professor J. W. Judd at the Royal College of Science and from then on he followed the path of geology. From the beginning he showed the industry and devotion to science which characterized his whole life, and he soon qualified as a teacher of geology and physiography. While at the Royal College of Science, he came into contact with many stimulating personalities in his science and made a number of friendships with men, notably Professor T. Rupert Jones and C. D. Sherborn, who did much to direct the course of his life. His early work under Judd on the material brought up from deep borings around London developed his interest, already aroused by his brother Robert, in the foraminifera, and under the guidance of Rupert Jones, he became the leading authority on these organisms. Between 1886 and 1902, when he left England for Australia, he published many papers, most of which were devoted to foraminifera, living as well as fossil, but he was also the author of a number on geological subjects. The best-known and most important paper of this period is his ' Foraminifera of the Gault of Folkestone ', which appeared in the Journal of the Royal Microscopical Society over the years 1891 to 1898, but he also described fossil foraminifera from many other localities in England and from Egypt, India, Christmas Island (with Rupert Jones), Barbados, California, and elsewhere, and Recent foraminifera from the Atlantic, Indian and Pacific Oceans. In 1901, he contributed to the Journal of this Society the first of his papers on the results of the expedition to Funafuti organized by the Royal Society of London to test Darwin's theory of the formation of coral reefs. The year 1902 saw the appearance of his well-known text-book ' The Foraminifera ', which, until 1928, remained the only work of its kind.

In 1902, Mr. Chapman, on the recommendation of Judd, was appointed by the Government of Victoria to the newly created position of palaeontologist to the National Museum, Melbourne. Previously the extensive collections of the Geological Survey of Victoria and a great quantity of foreign fossil material acquired through the efforts of Professor McCoy had been located at the University of Melbourne. They were now transferred to the National Museum, where Mr. Chapman's first duty on his arrival

in Melbourne was to arrange and name them. Apart from Robert Etheridge, junr., of the Australian Museum, Sydney, who was a much older man, he was the only professional palaeontologist in Australia. Surrounded with a mass of material, very largely undescribed, he found himself unable to specialize and his Australian papers accordingly cover an unusually wide field. They deal principally with the larger fossils, including land plants, sponges, corals, bryozoans, starfish, jelly fish, mollusca, crustacea and fishes, and these papers probably form his most important contributions to science. The foraminifera were not, however, neglected, and in his few leisure hours he continued his work on his favourite organisms, describing fossil material from Australia, New Zealand, the Pacific Islands, and South Africa, and Recent forms from the Australian coast, off New Zealand, and from the dredgings of the Shackleton and Mawson Expeditions to the Antarctic. In his later papers on the foraminifera, he frequently had as collaborator the writer of this note, who will always recall with pleasure the evenings spent with his old friend in his study surrounded by his books and collections and listening to his reminiscences of the many foraminiferal workers he had met.

In 1927, the beginning of serious oil research in Australia and Papua led the Commonwealth Government to appoint Mr. Chapman the first Commonwealth palaeontologist, with Miss Irene Crespin, who succeeded him in the position when he retired, as his assistant. For these duties, which consisted mainly of the examination of bore and surface samples collected during the oil surveys, his knowledge of the foraminifera and extensive experience specially fitted him and he was retained long after the retiring age until 1936, when he retired at the age of seventy-two. After his retirement, he continued to engage in scientific work. The death of his wife, who was his devoted and constant helper and companion, in 1904 was a great blow to him and he sought refuge in his work. He then wrote his last important paper, that dealing with the foraminiferal soundings of the F.I.S. ' Endeavour ' along the continental shelf on the east coast of Australia. Immediately it was completed he collapsed but apparently made a good recovery. He was, however, afterwards obliged to limit his activities and devoted most of the remainder of his life to writing his autobiography, which he did not live to complete, and to his gardening. He was greatly interested in the cultivation of Australian native plants and his last public appearance, on 4 September 1943, was at the Maranoa Wildflower Garden, at Balwyn, near Melbourne, of which he was honorary Curator. For some little time before his death it was apparent to his close friends that he realized that his end was near although he seemed well and showed his usual interest in life. On the morning of 10 December he had a sudden heart attack and expired an hour later. With his death passed a much-loved scientist and friend who, in a comparatively uneventful life, had laboured long and well in his chosen field of work. Of him, his friend the late Sir Edgeworth David wrote. ' No man since the time of Robert Etheridge, Jun., has more enriched our knowledge of the past forms of life in Australia and adjacent regions than has this worker, whose ability is matched to a marvellous industry '. His scientific output was large, over 500 books and papers coming from his pen. The better known of his English publications have been mentioned. The

works of his Australian period include ' New and little known fossils in the National Museum ' (in thirty parts), the Victorian Geological Survey Reports of the Malle and Sorrento Bores, ' The Cretaceous and Tertiary Foraminifera of New Zealand ', and a text-book ' Australasian Fossils '. Apart from his purely scientific works, he contributed many popular articles on scientific subjects and personalities to the Melbourne daily press. Many of these were subsequently published in his book, ' Open Air Studies in Australia '.

Mr. Chapman took an active part in the work of Australian scientific bodies and served from 1920 until his death as Australian representative on the International Commission on Zoological Nomenclature. From 1902 onwards he was Honorary Palaeontologist to the Geological Survey of Victoria and from 1920 until 1932 was part-time Lecturer in Palaeontology at the University of Melbourne.

His contributions to science were recognized by awards and honorary membership of scientific bodies in England, the United States, Australia, and New Zealand. He was elected an Associate of this Society in 1896. The Royal Microscopical Society conferred its honorary fellowship on him in 1929 and he received the Lyell Fund in 1899 and the Lyell Medal in 1930 from the Geological Society. W. J. Parr.

Carl Frederick Albert Christensen died on 24 November 1942. He was born in a village on the island of Lolland in south Denmark on 16 January 1872. He entered the University of Copenhagen in 1891, where he studied with the intention of following medicine as a profession, but eventually decided to specialize in Botany. His teacher was Professor Warming, well known for his ecological work and for his explorations in Brazil. Christensen, after receiving his degree in 1900, married a Miss Derschen and worked in the Museum of the University. His attention was first attracted to the ferns by finding the hybrid *Dryopteris remota* in Denmark. His monographic treatment of the American species of *Dryopteris* and his invaluable bibliographic work, the ' Index Filicum ', soon attracted the attention of workers on the Pteridophyta. Christensen's work did much to break up the unwieldy and unnatural genera adopted by Sir William Hooker and encouraged the acceptance of sounder evolutionary principles in the classification of ferns. His most recent ideas have been published in Verdoorn's ' Manual of Pteridology '.

Christensen was also the auther of a voluminous work on the history of Botany in Denmark and a study of the species collected by Forskål in Arabia.

In the course of his systematic work Christensen built up a considerable private herbarium and shortly before the War, he made arrangements for the disposal of this collection to the British Museum (Natural History). The transfer was, however, only partly completed when the War interrupted communication with Denmark.

Dr. Christensen was elected a Foreign Member of the Society in May 1931. A. H. G. Alston.

Hugh Neville Dixon (1861–1944).—With the death of H. N. Dixon the Linnean Society loses a very distinguished Fellow who was one of the

ablest of British amateur botanists and was recognized throughout the world as the leading authority on the taxonomy of the mosses, both British and exotic. Those who shared his special interests mourn the loss of a friend and advisor of unlimited kindness and unfailing good judgement.

Hugh Neville Dixon was born at Wickham Bishops, near Witham, Essex on 20 April 1861, and was the second son of Robert Walker Dixon and Susan Goodman. The Dixon family had been settled in the neighbourhood for several generations and the grandfather of H. N. Dixon was one of two brothers who founded a firm of farmers and millers well known in Essex. Hugh Neville Dixon was educated at Witham and Southgate ; he had a Nonconformist upbringing and was a lover of natural history from his early youth. In 1879 he was admitted a pensioner of Christ's College, Cambridge and graduated B.A. in 1883, taking honours in the Classical Tripos. He proceeded M.A. in 1886 and also graduated as B.A. and M.A. of London University. During his Cambridge days he had already acquired the interest in mosses which absorbed him for the rest of his life. Though he did not study botany at the university, he came into contact with C. C. Babington, then Professor of Botany, who encouraged his botanical interests. In the Long Vacations Dixon visited the Lake District and elsewhere ; his first publication was a note in the ' Journal of Botany ' for 1884 recording, among other discoveries, the finding of the interesting Mediterranean moss *Tortula Vahlinia* at Cherry Hinton, near Cambridge, where it still grows, though not in the exact spot where Dixon first found it.

On leaving Cambridge, Dixon went to Northampton to assist the Rev. Thomas Arnold, who was headmaster of a school for the deaf and dumb. Dixon remained in Northampton for the rest of his life, succeeding Arnold as headmaster in 1884 and retaining the post till his retirement in 1914. Though his professional work must have taken much time and energy, his other interests were many. Dixon devoted himself to an intensive study of mosses, mastering first the British, later the European and ultimately the exotic, flora.

In 1884, after he had been in Northampton only six months, he published a short list of Northamptonshire mosses. This was the forerunner of an immense series of papers on mosses. All of these show the clarity, fine taxonomic sense and meticulous accuracy characteristic of their author, and in them Dixon described innumerable new species and genera, cleared up many doubtful points and misunderstandings and added much to our knowledge of the bryology of particular regions. His greatest work, by which he will certainly be long remembered, is his ' Student's Handbook of British Mosses ', of which the first edition appeared in 1891 written with the help of the Rev. H. G. Jameson, who supplied the keys and the figures, basing them on those in his own previously published ' Guide to British Mosses '. The success of the ' Handbook ' both in England and America is sufficient evidence of its merits. It is enough to say here that it combines admirably the advantages of a complete and accurate scientific work with the aim stated in the preface—that there should be nothing in it unintelligible to the ordinary student. At the time the first edition was published the scheme of classification adopted was much superior both in practical utility and naturalness to that in any previous work on British

mosses ; it was perhaps a pity that the two later editions did not take more account of the development of views on the classification of mosses. Dixon did not disagree with these views, as he accepted them in his work on exotic mosses : his policy in this respect was probably deliberate, as he thought his original scheme the easiest for the beginner to understand. The only other of his works which appeared in book form was his ' Studies in the Bryology of New Zealand ' (1913–29).

As a systematist Dixon was greatly helped by his wonderful memory, which was both accurate and retentive. All his work was careful and thorough, and though his bent was for ' microtaxonomy ' rather than for the main outlines of classification, it was very valuable. Dixon was a keen collector and knew the European moss flora as well in the field as in the herbarium. Besides exploring many parts of the British Isles, he made important collections in other parts of Europe on journeys ranging from Tornean Lapland to Portugal and Sicily, many of them in company with his friend W. E. Nicholson. Among the most notable additions to the European moss flora made by Dixon and Nicholson were the discovery of *Distichophyllum carinatum* in the Salzkammergut in 1908, a species new to science of an otherwise tropical genus, and the many interesting discoveries made in 1911 in the Algarve.

The writing of the ' Handbook ' was not the only way in which Dixon assisted his fellow students of the mosses. He carried on a vast correspondence and was always ready to help a beginner. The humblest and youngest enquirer was answered with the same care and promptitude as a senior colleague. Dixon was a member of the Moss Exchange Club (afterwards the British Bryological Society) from its foundation ; he was President in 1923–4 and for many years a referee. Through this Society he did very much to encourage and help the study of British mosses, especially among amateurs.

Dixon became F.L.S., in 1885 ; was a member of the Council in 1925–30 and Vice-President 1928–29. His last contribution to our Proceedings, dealing with the alpine mosses of Sumatra, appeared in December 1944. He was Secretary of the Northamptonshire Naturalists' Society and Field Club from 1886 to 1931. He received few honours, certainly far fewer than his many years of excellent work deserved, mainly no doubt because the group of plants in which he specialized is not supposed to have much popular appeal. His herbarium of British mosses was left to Kew, and his foreign mosses, a collection of priceless value for reference and comparison, to the Department of Botany of the British Museum.

Dixon was far from being a narrow-minded specialist. He was an eminent and active Congregationalist and a Director of the London Missionary Society. He collected flowering plants as well as mosses and was a keen gardener. His other interests included wood and metal turning and county cricket ; he also produced small books of poetry beautifully illustrated. He was a man of enormous physical energy ; he climbed Skiddaw on his eightieth birthday, played hockey till he was over fifty and was an extremely powerful walker.

In manner Dixon was courteous and quiet. His strong but kindly features, bushy beard and hair which remained black till the end of his life gave him an appearance of great dignity. Though a reserved

man he was not difficult to approach. There were few pleasanter companions on a field excursion and he always delighted in a good talk and a good tale round the fireside after a long day out of doors.

He married in 1890 Mary Pressland, who predeceased him barely five months and they had one son who died young. P. W. Richards.

Thomas Alfred Dymes, who died on 29 October 1944 at the age of seventy-nine, was a familiar figure at the Society's meetings over a number of years. He was the son of J. J. Dymes, of Madras, and was educated at Eastbourne College, where his interest in the study of plants was aroused to such purpose that he won the Queen's prize in Botany. Subsequently he entered the Westminster Bank, in which he served till his retirement to Letchworth. But Botany remained his abiding hobby, and despite the handicap of asthma he devoted his leisure to the problems of dispersal and the study of seeds and fruits. His extensive collections were presented by him to the Herbarium at Kew. After his retirement he took a great interest in his garden and in the raising of seedlings of British species, and he also acted as Hon. Curator of the Herbarium of Letchworth Museum.

He contributed several papers to the Society's publications on biological subjects, and wrote a small book on 'The Nature Study of Plants', published by the S.P.C.K. in 1920.

Elected a Fellow in 1912, he was made an Associate in 1941. Kindly and quiet by disposition, he was never happier than when in the company of those of kindred interests. He seldom missed meetings of the Linnean Society or of the Linnean Dining Club, of which he was a member, and his passing leaves a gap in the ranks of amateur naturalists to whom field biology owes so much. E. J. Salisbury.

Sir John Bretland Farmer was born at Atherstone and educated at Atherstone Grammar School and later privately. It was the rural surroundings in which his youth was spent that awakened his interest in natural history and so determined his future career. At the same time he acquired a knowledge of, and outlook on, agriculture which was of great value to him in his later work. He entered Magdalen College, Oxford, in 1883, and was elected a fellow of his college on his appointment as demonstrator to Bayley Balfour, then Sherardian professor of Botany He eagerly welcomed an opportunity to visit the tropics and spent a valuable and fruitful time with Willis at Peradeniya. This experience gave him an insight into problems of tropical agriculture that served him well in later years. Amongst the material he brought back was a collection of dried and spirit material of the Jungermanniaceae on which he intended to work.

In 1892 he was appointed assistant professor of botany at the Royal College of Science, of which Huxley was then Dean, and after the latter's death he was made a full professor in 1895.

Farmer had a keen interest in liverworts, which he always retained, and intended to work out the material which he brought back from Ceylon; but other interests proved more absorbing. It was the rapidly developing knowledge of the structure and functions of the nucleus which immediately

attracted his attention, and he was much influenced by the recently published work of Strasburger. It was not surprising that the first of his own contributions in this field was on spore formation in the Hepaticae. This was followed by his investigations with Lloyd Williams of the nuclear cycle in the Fucacaee. The new subject of cytology was extending its field, and the discovery of Mendel's paper directed attention to the nucleus and its functions in heredity. Farmer's interest was drawn more strongly to investigation of the details of nuclear divisions and the behaviour of the chromosomes. He published alone and in collaboration with Moore, Digby and others a series of papers on mitoses in both plants and animals and put forward an interpretation of the behaviour of chromosomes in meiosis.

Recent work in cytology, especially in its association with genetics, and improvements in technique have yielded a knowledge of the details of meiosis, which have rendered the views of Farmer and his associates, as to events in the prophases, no longer applicable, though they confirm his view that the two divisions of meiosis are integrally related. Farmer was one of the pioneers in cytology and his investigations played an important part in the development of the subject. Amongst the papers published during this period were those on the cytology of aposporous and apogamous ferns. In 1903 with Moore and Walker he investigated the cytology of malignant growths in man and showed the presence of heterotype mitoses in cancer cells.

Whilst Farmer's main interest was thus centred in cytology, it was by no means confined to it. With other workers in his department he carried out or directed a number of investigations of the anatomy of ferns, especially of the Marattiaceae and Ophioglossaceae. Farmer was the author of some elementary text-books, and with A. D. Darbishire he edited the translation of de Vries's 'Die Mutations Theorie'. He was for many years an editor of the 'Annals of Botany'; he also edited 'Science Progress' and, for a short time, the 'Gardener's Chronicle'.

The period during which his most fruitful work as an investigator was carried on, witnessed a remarkable expansion of his department. The incorporation of the Royal College of Science in the Imperial College of Science and Technology in 1907, with its function of providing training and research in science especially in its relation to industry, provided the need and the opportunity for the development of Farmer's department. One industry with which botany is closely related is agriculture—in the broad sense. Agriculture, both at home and in our colonies, needed men trained in pathology, genetics, physiology etc., and these Farmer organized his department to provide.

When he retired, it comprised five sub-departments each with a professor at its head and was housed in two new buildings in Prince Consort Road. His students now occupy important positions not only in this country but in the Dominions, India and throughout the Colonial Empire.

Farmer's broad knowledge of the applications of biology, his powers of decision and ability as an organiser made him much in demand outside his department and he served on many public and departmental committees. He visited the West Indies, on behalf of the Empire Cotton Growing Corporation in 1925, and also played a large part in the establishment

of the Imperial College of Tropical Agriculture in Trinidad. Later he served on a Colonial Office Committee to enquire into the training of agricultural officers for the colonies.

Farmer was a born teacher with the rare gift of inspiring others with his own enthusiasm. He was a good field botanist and never happier than when leading a party of students. Over a long period he took them every year to the Snowdon district, and here he was on familiar ground, for he was a notable rock climber. He was a keen gardener with a special interest in alpines.

In all his personal relations he was a wise counsellor and a steadfast friend. He is sadly missed and not least by his old students, who, scattered widely over the globe, could always rely on his ready advice and support. R. J. Tabor.

Ernest Edward Galpin, Hon.D.Sc. In the death of Dr. Galpin on 16 October 1941, at the age of eighty-three, the Linnean Society lost a Fellow of over fifty years' standing, and South Africa lost her foremost amateur collector of the age. Born and educated in Grahamstown, the first inland establishment founded by the 1820 settlers, Galpin's schooling was cut short at the age of fourteen by his father's ill-health. When still quite a lad he saw active service on the eastern Cape Province border in the Gaika-Galeka native rebellion of 1877. On his discharge he entered the service of the Oriental Banking Corporation, later amalgamated with the Bank of Africa, in whose employ he remained for the rest of his commercial career. Transfers in the Bank's service took him to various parts of the country. He was not slow to seize these opportunities of studying and collecting the local flora in his spare time, and laying the foundations of a private herbarium which was later to become the nucleus of the National Herbarium of the Union of South Africa.

Galpin first took up the study of botany when stationed at Middleburg (Cape) in 1880. With the help of Harvey's ' Genera ', the three volumes of the ' Flora Capensis ' then published and a few text-books he managed to pick up sufficient knowledge of taxonomic botany to be able to determine the genus of the majority of the plants met with on his walks in the veld. It was not until 1889, whilst stationed at Grahamstown, that the idea of forming a herbarium took definite shape. Mr. G. F. Scott-Elliot, visiting Grahamstown at that time, gave Galpin much encouragement and advice.

Transferred to Barberton in 1889, Galpin opened up correspondence and an exchange of duplicate specimens with the leading South African botanists, Drs. Harry Bolus, Peter MacOwan, Selmar Schonland and Medley-Wood. Several amateur collectors, notably D. F. Gilfillan, also assisted Galpin in building up his herbarium. He augmented it further by subscribing for a set of Dr. Rudolph Schlechter's South African plant collections.

Not by any means the least factor contributing to Galpin's eminence in his hobby, was the whole-hearted co-operation of his wife, Marie Elizabeth de Jongh, who accompanied and assisted him on most of his collecting expeditions, including one to the highest peak of the Aberdare Mountains in East tropical Africa.

It was mainly the encouragement of I. B. Pole-Evans, C.M.G., also a

Fellow of the Linnean Society, then Chief of the Division of Botany, which led Galpin to present his herbarium to the nation. This notable event took place in 1917 by which time the herbarium contained over 16,000 mounted sheets and many more duplicated.

Even after the presentation of his herbarium Galpin continued to add to the collection. He was, however, not merely a collector of plants: the accumulation of a vast number of specimens, irrespective of scientific data was not his ambition. He collected ample material with good notes enabling him to distribute acceptable duplicates freely. Even when over eighty, with eyesight and strength failing, he maintained the high standard he had set himself in his prime. By the time of his death the number of specimens entered in his personal register was in the neighbourhood of 15,000. He fully deserved the complimentary title 'Prince of collectors' given him by his friend General Smuts, whose interest in botany is common knowledge.

In later years he added to his botanic laurels by contributing valuable works to the literature of South African Botany. The more important ones include 'The native trees of the Springbok Flats' (1925), 'Botanical survey of the Springbok Flats' (1927) and in collaboration with his son, Mr. E. A. Galpin, 'Biological notes on *Boscia Rehmanniana* and *Olea verrucosa*' (1935).

In view of the care with which he collected, often in little explored parts of the country, it is not surprising that among Galpin's specimens there are several hundred previously unrecorded species. It is only fitting that his name should be commemorated in the name of a genus *Galpinia* and in many specific epithets. *Bauhinia Galpinii*, the 'Pride of de Kaap' (Kaap valley near Barberton), one of his best horticultural discoveries, is already widely cultivated in South Africa as an ornamental shrub or hedge plant and is becoming popular oversea also. His botanical achievements were further acknowledged by the conferring on him in 1935 of the honorary degree of Doctor of Science by the University of Witwatersrand.

In addition to his membership of the Linnean Society he was a Life-member of the South African Association for the Advancement of Science, which he joined in 1903, the year after its foundation. It was rarely that he missed the annual session held in different towns each year, and many a young biologist received inspiration from his company. His kindly nature endeared Galpin to a wide circle of friends both young and old alike.

R. A. Dyer.

Walter Alan Campbell Gardiner. Alan Gardiner, who died on 29 August 1943 was elected a Fellow on 6 May 1937, and sat on the Council from 24 May 1941. He never enjoyed good health, but he managed nevertheless to enjoy his own life and enrich those of his colleagues and friends. One said 'I always wanted him when I was depressed and things were going wrong.' So his death at the age of forty-six came as a great shock to the wide circle of friends and colleagues who were so fond of him. Both freshwater and marine biologists will miss his papers on plankton and allied subjects, which always showed close observation, clear thinking and the balanced self-critical view that somehow seemed part of his sense of humour, and earned him his reputation for reliability of a very high standard.

His scientific work started in 1919 with Rowland Southern, at the 'Limnological Station' on the River Shannon, where it enters Lough Derg. He and Southern occupied two houseboats, which made a floating laboratory and living quarters. They took regular samples of plankton, with complete devotion, for several years, and so were able to give reliable information on what did in fact happen to the plankton of a large lake and river, over a sustained period. Results were published in the Proceedings of the Royal Dublin Society in 1927, 1932, and 1938. The paper on diurnal migration has particularly wide interest.

On the signing of the treaty setting up Eire, many English civil servants were sent home, Gardiner among them. He was always sorry at having had to leave Ireland. He worked successively at the Alresford Laboratory, at Lowestoft, and at the Metropolitan Water Board, with interruptions due to illness.

In a paper from Alresford he showed how resistant ova and fry of trout are to tar acids, in concentrations strong enough to kill adult trout. At Lowestoft he turned his experience of freshwater plankton sampling methods on to marine work. His handiness with apparatus produced a giant Stempel type of pipette, and he wrote in 1925 on experiments in sampling by Petersen's Young Fish Trawl, which he found remarkably 'quantitative', and on similar critical observations on the more rigorously designed vertical nets. He liked the Marine Biological Association journal, and we find papers of his there on this kind of problem, in 1931, 1933 and 1934.

Interest in the chemical conditions of the water followed naturally, and he delighted us all by his simple demonstration of the astonishing quantity of phosphate excreted by live plankton animals, taken straight from the sea, and kept alive on board the *George Bligh*. Among other subjects was a single smallish *Cyanea*, 'which was subsequently found to have been harbouring 6 *Hyperia galba*' (a characteristic Gardiner touch) which raised the P_2O_5 in 2 litres of sea-water from 6 mg./m.^{3} to 25 mg./m.^{3} in 3 hours.

In his plankton observations Gardiner often found that the animals, and indeed the plants too, did not behave according to the simple plans that were supposed to govern them. In his work for the Metropolitan Water Board he was chiefly concerned with the plants, and he found that the conditions of outbreaks left much to be explained. The management of reservoirs, so as to avoid the effects of diatom outbreaks on filter beds, is an immediate practical problem, and Gardiner's work was planned to obtain the data and correct theory for forecasting the incidence and duration of these outbreaks. It was therefore important when he showed in his paper of 1941 that the correlation of rate of growth with supply of phosphate and silicate is confined to the early part of the season. Other laws were required for the rest of the year, and their formulation was one of Gardiner's main aims. At the time of his death he was engaged on the following subjects: a counting method for use with Utermohl's microscope; seasonal changes in the population of *Asterionella* in reservoirs; pure culture methods for *Nitschia*; fluctuation in number of cells per colony in the same diatom. The Freshwater Biological Association has agreed to assist in bringing his results to publication. His last paper,

on the pigment extraction method of measuring phytoplankton production, has just been published in the M.B.A. journal.

Hardy ('Nature,' v, 152, p. 498) has used the word 'quality' for Gardiner's work, and this was equally applicable to his life. Owing to ill-health he had to change his work often, and even in the good periods he had frequently to take time off for sickness. Yet no one of his colleagues could ever think of him as a passenger; and every staff with whom he worked found a serious gap when he left. Somehow he acted as a tonic to the rest of us. He criticized vigorously, but we could never resent that because we knew that he criticized himself even more severely. He loved comfort when he could get it, but, in spite of his ill-health and the trouble of the precautions that he had to take, he was always willing to go to sea at any time of year; and he was an outstandingly able sea naturalist. He was always ready to do more than his share, and to take a humorous view of the discomforts. The ship's officers and men had the greatest respect and affection for him; and we always knew that Gardiner would bring back an answer to a sea problem, if anyone could.

One perhaps minor effort of recent years was especially characteristic. Latterly he decided to make a special point of clear and audible exposition, applying to scientific topics, he averred, the Golden Rule of after-dinner speaking, 'Stand up, speak up, and shut up'. As a result we had the pleasure at a number of meetings of a lucid and easily audible interval when Gardiner's turn came.

In spite of all that Gardiner managed to do for us, setting as it were a standard, both of scientific work and of professional behaviour, the hard fact remains that we have lost a man whose best work was in front of him. He did not have the opportunity of rounding his work off so that its lessons could be in compact form and readily learned. This makes it all the more important to study his papers closely, whether or not they are directly relevant to the research we may have in hand. In fishery research his work can be placed with that of Holt, who was his first chief, as a guide to what we have to do, and how it should be done. MICHAEL GRAHAM.

WALTER AMBROSE HEATH HARDING (1870–1942) was the only son of Col. T. W. Harding, J.P., D.L., of Madingley Hall, High Steward of the Borough of Cambridge and High Sheriff of the County. He belonged to an old Cambridgeshire family which resided at Connington in the thirteenth century, later moving to Doddington, where they were greatly concerned with the drainage of the fens. He was educated at Cheltenham College and Peterhouse, where he was known for his contributions to University journals and as Secretary of the Browning Society. His health was poor and after taking his degree he started on a long voyage to South America and round the world. Subsequently his journals were of particular value, for he prepared a new edition of Waterton's 'Wanderings in South America', to which he added many explanatory notes; he also made sketches wherever he went, those of Cape Horn being particularly interesting.

On his return he joined the 2nd Batt. Cambridgeshire Regiment; as Captain and Adjutant he took a special part in recruiting, especially for the South African War, but he himself was rejected on medical grounds.

In despair at this he ceased to take any active part in politics though he remained a member of the Carlton Club.

In 1895 he married Ethel Adela Hirst of W. Yorks, and settled at Histon Manor, where he established a zoo principally inhabited by birds and small mammals, especially lemurs—these he kept partially for his own interest but largely at the service of biological institutions; the breeding habits of many were studied and in particular the salts employed in the plumage of birds, the Turacow being especially investigated. A portion was kept for leeches, and at one time he had living there every English species, a revision of which he published in 1910. On this group he wrote about twenty notes and reports, the most important being a monograph on the jawless Leeches in the Fauna of British India: in connection with this he employed a collector to go all over India hoping to obtain living material, but, unfortunately, the case was labelled 'living animals' and was left on the deck in the sun. Previously these Indian leeches had been classified entirely by their external appearance, but he worked out their structure and added a series of remarkable diagrams illustrating their internal anatomy.

After his father's death he moved to Madingley Hall but largely gave up his collection of living animals.

He was connected in all these years with the Zoological Laboratory and with his father founded in 1912 a zoological lectureship which bears the name of Harding and has always been associated with experimental teaching. For many years he assisted in the Balfour Library to which he presented many volumes. He was, too, a discriminating collector of books, his library of about 10,000 volumes containing very many 'incunabula. He was also a collector of Chelsea and Bow Porcelains and of Delft, particularly the pharmaceutical ware, of which he published several accounts.

For some years before his death he was engaged on a book dealing with geographical distribution in relation to our present ideas of heredity and variation.

His wife died in 1942 and he leaves a son and a daughter.

J. Stanley Gardiner.

Bertram Lloyd, 1881–1944. The subject of this notice was born in North London on 14 May 1881. He received his education at the Merchant Taylors' School and during his youth spent two years in Germany when he acquired a fluent knowledge of German. He translated many masterpieces of poetry and drama from German into English. During the earlier days of his life he assisted his father in an insurance office but his duties in this position were incompatible with his nature. We get a clue to his true leanings and his incisiveness in following them by the fact that he, accompanied by his brother, lived for about a year in Bethnal Green to get first hand information of social conditions, which were to him an absorbing interest.

Among the various subjects which engaged the attention of Lloyd natural history played an important part although he was not a specialist. He was a keen, active and discerning field-naturalist and as such devoted much observation to birds, dragonflies and other subjects. In 1921 he

contributed to ' British Birds ' a note entitled ' Stone-Curlew in Buckinghamshire ' and continued to publish notes, many dealing with Pembrokeshire, in this journal until his death. These notes included one, ' On the Egg-laying of the Grassholm Gannets ' (1926) and another ' Marsh-Warbler at Wilstone Reservoir ' (in June and July, 1941), this being the only occurrence of this species in Herts which has been published.

For some years he devoted special attention to the birds of the island of Texel (Holland). To the pages of the ' Entomologist ' he contributed in 1941 ' A mass Emergence of the Dragonfly, *Coenagrion puella* ' and in 1944 ' The Dragonflies of Pembrokeshire '.

He was a tower of strength to the Hertfordshire Natural History Society during a membership of some twenty years. He was editor of the Transactions from 1935 till his death. He made many contributions to that Society's journal. As examples of these may be mentioned ' The Nesting of Garganeys at Elstree ' (in 1931) and ' The Distribution of the Grass Snake in Hertfordshire, with Notes on its Behaviour ' published in 1936. After the death of his close friend, Charles Oldham, to whose memory he paid graceful tributes in ' British Birds ' and also in ' The North Western Naturalist ', he edited the Reports on Birds for 1939, 1940 and 1941. He was also the Society's recorder for Mammals, Reptiles and Batrachians.

Lloyd was elected a Fellow of the Linnean Society on 7 March 1935. He was also a Fellow of the Royal Entomological Society and a Member of the British Ornithologists' Union.

He died on 9 June 1944 after a long and trying illness. He married Miss S. N. Colenso, by whom he is survived. W. E. Glegg.

The Rev. Professor Edward Shefford Lyttel, who died in August 1944, was Professor of History at the University College, Southampton, from 1912 to 1934. In his spare time he had two passions, the growing of plants and chamber music. He was for many years President of the Southampton Chamber Music Club which he had founded. He was also President of the Southampton and District Gardeners' Society, which is a very flourishing Society, largely owing to his enthusiasm. Professor Lyttel was particularly interested in ericaceous plants and lilies. After his retirement from the College he devoted much time to the cultivation of his favourite plants at his garden, ' Nyewood ', just outside Southampton. Here he had gathered together a wonderful collection of uncommon plants. Lilies grew there particularly well, owing to his care and good cultivation. He grew many different species of lilies, in fact, every species that was obtainable. Many he raised from seed. He took infinite trouble to find out how each lily should be grown, and owing to his patience and skill nearly every lily species grew well in his garden. In his later years he became attached to rock plants and the cultivation of the more difficult ones. He was President of the Alpine Garden Society. The propagation of plants always interested him, and during the last years of the war he told me he was propagating all the plants he could to distribute to young gardeners and the trade to start them off again when they came back from the war. He was always anxious to help other gardeners and especially young men and women.

In order to encourage the cultivation of lilies and rock plants he gave a magnificent Cup to the Lily Group of the Royal Horticultural Society, and another Cup to the Alpine Garden Society to be awarded annually to those who had done most during the year for the cultivation of these plants. F. C. Stern.

Cecil Victor Boley Marquand (1898–1943) will live in the memory of his friends chiefly as an enthusiastic field botanist and student of the bryophytes with a passionate love for mountain climbing and mountain scenery. Though throughout his professional career he worked mainly on the flowering plants, the mosses and liverworts were his chief love and in collecting them he spent most of his leisure hours. His tragic death by drowning off the Isle of Skye came as a shock to many, above all to those who knew him as a companion in their field excursions.

C. V. B. Marquand was born at Richmond, Surrey on 7 June 1898. He was the only son of the late E. D. Marquand, who is remembered for his 'Flora of Guernsey' and for his work on the plants of West Cornwall. After a somewhat unusual school career spent partly at Elizabeth College, Guernsey, partly at the Lycée Henri IV in Paris and partly at Bedford School, he went to Christ's College, Cambridge, where he proceeded to the B.A. degree in 1919. He served in the war of 1914–18 first in the Machine Gun Corps, afterwards with a commission in the Royal Tank Corps, until he was invalided out. The war, though it left his physical strength little impaired, was no doubt responsible for the recurrent nervous trouble from which he suffered during the rest of his life, ultimately making necessary his early retirement.

His first appointment was as Research Assistant at the Welsh Plant Breeding Station, Aberystwyth, where he was put in charge of investigations on oats. Here he did useful work and published a valuable paper on the 'Varieties of oats in cultivation'. While at Aberystwyth he acquired an interest in genetics which he afterwards retained, though his later work was almost entirely taxonomic. In 1923 he joined the staff of the Royal Botanic Gardens, Kew, where after a short period of further work on grasses he took charge of the Chinese section of the herbarium. While holding this post he wrote a large number of papers on the flora of eastern Asia, the most notable of which were his revisions of *Cyananthus*, the Old World species of *Buddleia* and the Chinese species of *Gentiana*. Later he became responsible for the collection of bryophytes in addition to his other duties. Though these were undoubtedly his favourite group, little official time could be spent on them, the bryophytes being at Kew, as elsewhere, the Cinderellas of the plant kingdom. During holidays in Scotland, Wales, Norway, Spain and the Alps Marquand acquired an intimate knowledge of bryophytes in the field, particularly of the Arctic-alpine species. Some of this knowledge was embodied in a useful paper on the 'Bryophyta of Arctic-alpine associations in Wales' (Aberystwyth Studies, vol. iv, 1922); apart from this he published little on the bryophytes. Marquand was one of the most active members of the British Bryological Society, the members of which will greatly miss him, and regularly attended the annual meetings.

In 1939 his health made it impossible for him to continue his work at

Kew and after his retirement he went to live in Skye, where he could give his whole time to field studies. His untimely death at the age of forty-five was due to an unfortunate accident; with characteristic impulsiveness he set out in a motor-boat, disregarding a warning that the engine was unreliable. The boat was afterwards found floating upside down and his body and that of his companion were later seen in an inaccessible cave. P. W. Richards.

The death took place on 1 December 1943, at Cedar Mount, Dundrum, of Canon H. Kingsmill Moore, D.D., former principal of the Church of Ireland Training College, Dublin, at the great age of ninety years. Canon Kingsmill Moore was recognized as an authority on all educational matters and was the author of many books on them. He was engaged up to the time of his death on a work 'Advice to Clergymen regarding the management of Lands and Gardens'. He was a member and supporter of the Royal Horticultural Society of Ireland for many years, and a constant and successful exhibitor at its shows. His chief interest lay in his well-known and famous collection of ferns, the most distinct and beautiful of which had been raised by himself. In the volumes of the British Pteridological Society there are many references to his work. He won many awards and honours for new varieties.

Canon Kingsmill Moore contributed frequently to the 'Bulletin' of the R.H.S.I. In the issue for October 1943, he had a most interesting note on *Lastrea dilatata nana* which, supposed for many years to be lost, was rediscovered, most happily in the garden of the Canon's son, Senator Kingsmill Moore, K.C., a discovery which gave the Canon very great pleasure. Canon Kingsmill Moore was born in Dublin and was educated at Midleton College, Bromsgrove, and Balliol College, Oxford. He was a man of ability and culture, most kind and generous to plant lovers, helpful and encouraging in advice to all interested in ferns. He was elected a Fellow of the Linnean Society on 6 March 1930. His death is very much regretted in horticultural circles. F. W. Moore.

John Roxbrough Norman was born at Putney on 9 September 1898, the younger of twin brothers. He died at Tring on 26 May 1944. By his death at the early age of forty-five, ichthyology has suffered an irreparable loss and his many friends a sad bereavement.

On leaving St. Paul's School, Norman entered Lloyds Bank until he was commissioned in the Queen Victoria's Rifles in 1917. Whilst serving at Deepcut he contracted rheumatic fever, which permanently injured his health and he was invalided out of the Army in 1918. Fortunately for science, he then started to study zoology at the Imperial College in South Kensington. It was a penalty of his genius that he did not remain a student long enough to take his degree, as, a vacancy occurring on the staff of the British Museum (Natural History), the late Professor E. W. MacBride immediately nominated Norman to fill it.

'J. R.', as he was always called by his friends, entered the Museum in 1921 and took over the collections of fishes from Charles Tate Regan, who had just been appointed Keeper of Zoology. He had already shown his leaning towards ichthyology by his research on the development of

the chondrocranium of the eel, a paper which was subsequently published by the Royal Society in 1925. Probably no new member of the staff of the British Museum will ever again be asked to tackle such a huge field as the whole group popularly known as Fishes. But, thanks to an infallible memory and a positive talent for methodical work, Norman soon acquired such a knowledge of his subject as established his reputation whilst he was still a young man. The publication of his 'History of Fishes' in 1931 proved his early mastery of ichthyology and his great desire to let others share his love of the science. His constant wish to share his pleasures with others was the reason for his having so many friends.

In 1921 the Fish Gallery in the British Museum was still arranged under an archaic classification—J. R. was determined that this should be remedied and set about the collection of material and the preparation of specimens at once. In the meantime he attacked the great number of mixed collections which needed naming, though, like many of his colleagues, his ambition to keep abreast of the acquisitions was never satisfied. His work as curator was greatly increased by having to undertake revisions before he could name the specimens to his satisfaction. By 1927 the 'Discovery II' collections from the Antarctic and Southern Oceans began to arrive, and it was this important series of Reports which Norman wrote that established his reputation as a systematist. These collections were followed by others made by the British, Australian and New Zealand Research Expedition, the John Murray Expedition and numerous individual collections. In fact, there were few parts of the world neglected by the collectors who were all anxious to get Norman to name their material. In the course of these investigations he soon realized that many large groups of fishes sadly needed a thorough revision. Having published papers on certain genera and families, he now tackled in order, the Flatfishes (Heterosomata), and produced the first volume of this important monograph in 1934. That he did not live to complete the second volume is a great loss to science.

All this time the work in the Public Gallery was proceeding and the preparators were inspired by Norman's enthusiasm to create an exhibition that would really be of interest to both the layman and the scientist. Hundreds of new casts and models were made, from a whale-shark over fifty feet long to a minute mosquito-eating top minnow, also numerous skeletons, dissections and drawings prepared. The classified series was reduced and is now confined to one side of the Gallery. Exhibits illustrating commercial fisheries, coloration, torrent-fishes, cave-fishes, deep-sea fishes, breeding habits and development, etc., have brought the Gallery into line with modern ideas and stressed the educative function of a museum. Nor has the sportsman been forgotten, for two large cases are now devoted to game fishes of the sea and fresh water. All was completed in 1936 and an illustrated guide, written to be easily read as a simple text-book by anyone interested in Natural History, was on sale the following year.

Norman was elected a Fellow of the Linnean Society in 1923. He was a regular and well-remembered figure at every meeting and never failed to add some valuable contribution to any discussion. He served

on the Council from 1940 to the time of his death and was Vice-President in 1940–41.

On the outbreak of the present war he was transferred to Tring to take charge of the Zoological Museum, recently bequeathed to the nation by the late Lord Rothschild. Here he helped with all the necessary arrangements for the photographing, on micro-film, of the whole of the Linnaean Collections ; a description of which tremendous task he gave to the Society in November 1941. He also created a transformation in the exhibition galleries by rearrangement and relabelling. Finally, he completed his part of a work planned with Dr. G. S. Myers, of Michigan, U.S.A. This was to have comprised a synopsis with keys of all the families and genera of fishes. In the autumn of 1943, however, his health rapidly failed and he was forced to stay away from the Museum, though he continued to do work from his bed as long as he was able. It was then that he completed a biography of his great friend, the late Dr. C. D. Sherborn, the compiler of the ' Index Animalium '.

Norman married, in 1927, Margo Hirons, and they set up a home in Chiswick. Very many visiting scientists from overseas, not only ichthyologists, must have happy memories of evenings spent under that hospitable roof. To Margot and to his two children, Robin and Ruth, the sympathy of J.R.'s many friends is extended.

The writer was privileged to work in Norman's room at the Natural History Museum for some fifteen years and would like to acknowledge J. R.'s most endearing quality, that of suffering fools gladly. His unfailing courtesy never left him when faced with either a stupid enquiry or a difficult problem, and no one ever met Norman without feeling that he had made a friend.

W. P. C. Tenison.

I have been allowed to add a short personal tribute to a colleague whose loss is a great blow to me.

Norman had reached the height of his powers, and in conversations during the war years he gave me a fair idea of how he hoped to employ those powers. His ambitions were bound up with the British Museum (Natural History), and he had a broad and balanced conception of its functions. His work on the exhibition gallery testified to his appreciation of its rôle in the general education of the public. Before all, however, he recognized that the British Museum is one of the few institutions in the world that can be expected to aim at a reference collection representative of the fauna and flora of the world. He knew that the only way to bring such a collection to anything approaching completeness was to name and report upon incoming collections, and keep their classification as far as possible up-to-date, so as to encourage a continued inflow of material. With a limited staff, he saw that this meant only an approximate exactitude along a broad front, coupled with thorough world revisions of restricted groups. Deeper investigations and the elucidation of major classification he realized must be relegated to unofficial time, as far as the curator is concerned, and he hoped that more workers could be attached to the museum to carry out such deeper research, unburdened by the care of the collections.

In pursuance of his aims, Norman was intending, before his last illness,

to follow his flatfish work by a monograph of the Blennioidea. His last publication was an earnest of this intention. His wide knowledge of marine fishes had caused some general ideas on the marine side of zoogeography to take shape in his mind, and he was looking forward to developing his views in this field. Günther's 'Catalogue of Fishes' had always been kept up-to-date as a list, though not as a descriptive classification. Norman recognized that no one person could hope again to produce a descriptive catalogue of the whole group. Instead of this he embarked upon a synopsis and keys of all the families and genera of fishes (Dr. G. S. Myers, of Stanford University, was collaborating in this), and he had carried it as far as war-time separation from specimens and libraries permitted.

Norman's courtesy and willingness to see both sides, as well as his undoubted ability, commended him as a committee member, and he served on the councils of the Linnean Society, the Marine Biological Association and the Zoological Society. Of the latter he was, at the time of his death, a Vice-President. For several years he was honorary Secretary of the 'Challenger' Society. When the Colonial Office appointed a Fisheries Advisory Committee, Norman was made a member. He enjoyed the pleasant relations established by correspondence with ichthyologists abroad, and his election in 1939 as an Honorary Foreign Member of the American Society of Ichthyologists and Herpetologists gave him great pleasure.

During the last few years the care of the freshwater fishes at the Museum had been handed over to me. J. R. had much to teach me, especially in curatorial method, but he never employed a didactic tone. Our conversations had the flavour of a sharing of ideas, and he relied more upon example than on words. His orderly methods make it easy to pick up the threads of his work, but to follow him worthily will not be easy.

ETHELWYNN TREWAVAS.

Dr. WILLIAM RUSHTON PARKER, a member of the Linnean Society of London, the Royal Institution of Great Britain and other scientific societies was born in 1853, probably in Liverpool his father was a well-known surgeon in that city. He died a bachelor at Kendal, Westmorland on 22 November 1943, the day after his ninetieth birthday.

Dr. Rushton Parker was in practice as a doctor in Kendal for twenty-five years from 1887, retiring on 31 December 1912. Whilst resident in the town he became prominent in public affairs, being elected to the Town Council prior to 1896. He was an Alderman of the Borough from 1913 until his resignation in 1919. While a member of the Kendal Town Council he was instrumental in obtaining from the Carnegie Trust the funds for the building of Kendal's fine Library. He was a founder of the Meathop Sanatorium in Westmorland.

After retiring from practice as a doctor he spent his long and very active life in travelling, studying nature and in a relentless effort to improve our educational system. To this end he contributed very generously large sums of money to libraries, museums, schools and other public institutions. He was deeply interested both in the Kendal Museum (to which he presented numerous specimens of rare birds and animals) as well as in the

Kendal Library which benefited greatly from his generosity over a period of many years.

The British Museum (Natural History), thanks to Dr. Rushton Parker, is the richer for the skeleton of a mammoth (the remains of which were found during the excavation of the foundations of a building in the city of London) and of a prehistoric horse from S. America.

He was fearless in the expression of his opinions, especially when it concerned educational matters. He believed that nothing should be taught in the schools, (neither religious nor otherwise) which could not be explained and corroborated scientifically.

From his youth onwards he was guided by an irresistible urge to raise the standard of education. In one of his letters he wrote :—' My education at Epsom for six and a half years was rotten in every form from one to six. I wrote a letter to the " British Medical Journal " stating this. All the council (being medical men) read my letter and decided that either the headmaster or all six prefects must leave at once. The headmaster had to leave, and so saved us prefects. The new headmaster, possibly knowing or guessing that I was the author of the letter, excused me from all teaching, although I was only fifth prefect, and left me to work by myself in my own study and I learned more in my remaining year than I had learnt in the previous six and a half years. In fact on the day I left I carried off £320—in scholarship and a huge box of prizes.'

In his youth Dr. Rushton Parker was a ship's doctor for emigrants to New Zealand. He followed up this by travelling on horseback through both the North and the South Islands as doctor to an insurance company. His adventures on these and other journeys would fill a book. He wrote a large number of essays on his observations of nature, animal life, etc. Many of his writings appeared in the ' Westmorland Gazette.'

As a doctor he was gifted with a remarkable insight into human nature. He was very conscious of the power of mind over matter, and when people came to him about illnesses which he believed mainly imaginary he gave them, with all seriousness, a bottle of coloured water with strict instructions as to taking the same. More often than not the malady was cured thereby. On one occasion a boy imagined that he could not walk upstairs. Dr. Parker told him to go up at once. The boy still protested his inability when Dr. Parker stabbed him with a needle. With a shriek the boy ran upstairs and from that time onward his imaginary inability was cured !

Travel was the only luxury he allowed himself. In all personal matters he was most parsimonious, spending practically nothing on his clothing. He neither drank nor smoked, ate very little and that only of the plainest foods. Though he gave away thousands of pounds for public benefit, he would purchase for his own use a pair of plimsols for one shilling ! He wore them continually, saying that they served the purpose and that he disliked extravagance !

One of his last gifts to Kendal was that of a communal kitchen which has been of inestimable value in meeting wartime needs. It was first used to accommodate evacuees and subsequently converted into a British Restaurant. Shortly after its opening it served over 2,400 dinners every week. Dr. Parker has also made arrangements for the serving of hot midday meals to school children. Within a few months of his death he

purchased a motor car in order to visit the county schools and organize libraries in connection with the Kendal Library.

His last travels (in his eighty-sixth year) took him up the Nile, to its source, through the Belgian Congo, into Uganda, Kenya, the Mountains of the Moon, Victoria Nyanza, etc.

At the age of eighty-eight he said that but for the War he was ready to start for any part of the world ! At this advanced age he often read ten hours daily and wrote essays on the most varied subjects.

His many philanthropic interests absorbed him so much that he had few personal friends, yet he was never lonely, for he used to say that he was never so well entertained as when he was by himself.

Though a doctor he was never known to take medicines, and he disliked a doctor's advice, saying that nature was the surest healer.

The only times he ever seemed annoyed was when he was mistaken for Bernard Shaw, whom he resembled very closely.

Dr. Rushton Parker was repeatedly proposed as Mayor of Kendal, was also offered the freedom of the city, but he refused all honours.

LEON B. DE SAUVANNE.

EDWARD BAGNALL POULTON, who died 20 November 1943, was born on 27 January 1856 at Reading, where his father was an architect. He went in 1865 to a school founded by Mr. W. Watson at Oakley House, Reading. In 1872 he entered his father's office, but his heart was in science rather than architecture. His parents wisely allowed him to read for a scholarship at Oxford and he went to lectures by Rolleston whose magnificent personality made an abiding impression.

He gained an open scholarship in science at Jesus College, Oxford, in 1873 and obtained a first class in the Honour School of Zoology in 1876. Next year he was appointed demonstrator to Rolleston, but there was little opportunity for research and the remuneration was so small that he studied Geology under Prestwich for a University Scholarship. The Burdett-Coutts scholarship fell to him in 1878 with the result that he ceased demonstrating in zoology and conducted his first research under Prestwich, on mammalian remains and tree trunks in quaternary sands at Reading ; his paper published on this in 1879 was his first contribution to Science. Geology, however, was not his destiny.

Having been appointed lecturer in natural science at Keble and Jesus Colleges in 1880 all his available leisure was devoted to research. Early in 1882, under the influence of Moseley, who had succeeded Rolleston, he commenced an investigation of the structure of the tongues of *Ornithorhynchus* and other Australian animals : these and other studies were published in 1883–84 and led to the consideration of the structure of the hair of *Ornithorhynchus* which suggested reptilian scales.

Desiring to study the hair in a young animal he obtained the loan of sections prepared by Dr. W. N. Parker in which he found true teeth many-rooted and of complex form. Further research showed that these cut through the gum but are replaced by the horny plates of the adult. This important discovery was communicated to the Royal Society in 1888.

Poulton's real interest, however, from his youthful days had been in insect life, though the kind of entomology upon which he had seen J. O

Westwood engaged at Oxford had not appealed to him, for Westwood's bent was towards the dry bones of taxonomy. The first stimulus was provided by Wallace's ' Essays on Natural Selection ' which he read in 1878, and they aroused a life-long interest in the coloration of insects. Then he read Weismann's studies in the theory of descent in which he found an account of the variation in colour of a caterpillar according to the colour of the leaves of its food-plant. Stimulated by this Poulton conducted researches which led to the publication by the Entomological Society of London of a series of papers from 1884–88 on the colours, markings and attitudes of Lepidopterous larvae and pupae.

The essential nature of the colouring of phytophagous larvae and the colour-relations between pupae and their immediate surroundings were the subjects of papers published by the Royal Society in 1885 and 1887. It should be noted that from the very beginning Poulton stressed the importance of attitude in relation to coloration : a point which he never omitted in his arguments for the production of protective coloration by the operation of Natural Selection.

These researches led to his election to the Royal Society in 1889. Next year his book ' The Colours of Animals ' at once brought him to front rank among Darwinians. This remarkably interesting book explained the origin of all types of coloration by natural selection, except those due to the subordinate principle of sexual selection. They are fitted into a harmonious scheme, with appropriate names supplied by A. Sidgwick derived from the Greek. Emphasis is laid on the essential unity of such apparently different phenomena as the concealing (' cryptic ') resemblance of a caterpillar to a twig, and the deceptive (' pseudaposematic ') likeness of a conspicuous butterfly to another, better protected against attacks of vertebrate enemies. The term ' Mimicry' commonly used for the latter case so often leads to misunderstanding of the true cause of the phenomenon that it would be much better if it were dropped in favour of the term coined by Sidgwick.

The Hope Professorship of Zoology was awarded to Poulton on the death of Westwood in 1893, and for forty years he devoted himself to the care and enlargement of the famous collections, paying special attention to bionomics. Thus Oxford became the centre to which observers and field naturalists all over the world looked for help and encouragement and never failed to get a generous measure. During these years Poulton contributed or aided others to contribute, or inspired, a multitude of papers, mostly published by the Entomological Society, dealing with the relations of insects to each other and their geographical forms and distribution.

It is proposed here to consider more especially some of his communications to the Linnean Society of which he became Fellow in 1887. The degeneration of the appendages in the females of certain moths appearing in the winter was considered in 1891. He suggested that this originated in the fact that certain species without functional mouth parts in the adult did not need wings to take them to their food and, as they oviposited on very common plants or else large trees, did not need wings for the purpose of distributing eggs. Thus wings shrank, and the abdomen became larger and contained more eggs. The active male had its antennae more and more developed to enable it to find the sedentary

female, whose antennae became less needed and underwent degradation, reaching an extreme degree in certain Psychidae. A communication entitled ' Natural Selection the cause of mimetic resemblance and common warning colours ' (1898) was subsequently reprinted with other addresses in his ' Essays on Evolution ' (1909). Arguments for natural selection were, *inter alia*, the entire independence of affinity exhibited by these resemblances ; the limitation of the mimetic resemblance to superficial likeness ; the complexity of the resemblance ; the close space-time relationship between model and mimic ; and the production of the same resemblance in different ways. Two Presidential addresses 1912–14 were concerned with a remarkable pamphlet dated 1849, which, if genuine, would have anticipated much of Darwin's thoughts. Poulton's untiring search for truth and genius for detail are most clearly revealed in these addresses. His Presidential Address for 1916, in the first part, demonstrated examples of the hereditary transmission of small variations and the origin of butterfly mimicry. The importance of the former point lay in the claims of the early mutationists that the ' small ' variations which Darwinians believed to be the material on which selection worked are not heritable and that only ' saltations ' are inherited. This view always aroused vehement opposition from Poulton, and in the closing paragraphs of the address he ridiculed the extreme development of the mutation theory put forward by Bateson in 1914.

The second part of Poulton's address disclosed an important principle which helps in the understanding of the production of mimetic (Pseudaposematic) resemblance which, in butterflies, is mainly developed in the female sex. Although the pattern may be similar in model and mimic there is a difference in this respect : the border of the pale areas is sharp and clean cut in the model, soft and blurred in the mimic owing to admixture of dark and pale scales. This same relation obtains between a male and a female of a species ; and Poulton pointed out that the soft outline (Dyslegnia) has preceded mimicry and is found wherever there has been a recent change, of which it is the usual accompaniment. Eulegnia is found in males, and in models. This radical difference between model and mimic controverts the facile suggestion that a similar pattern is evolved by similar genes.

This address also provided facts suggesting that mimics are kept up to a high standard of resemblance by the presence of abundant models A family of *Papilio dardanus* (dubbed by Poulton ' the most wonderful butterfly in the world ') bred from a rare form of female provided female offspring of two types. One resembled a model abundant in the vicinity and varied little : the other, resembling no known species, varied greatly. The inference drawn was that the facies of the latter is un-selected, as it does not matter to the species which specimen is taken by enemies. But the mimetic form has been kept true to type by selection, which has weeded out those departing from close resemblance to the model.

Polymorphism is closely associated with mimicry, and we are probably only at the beginning of grouping together as one species multitudinous forms described under different names. Much is due to Poulton's enthusiastic influence on workers in the field, and one notable discovery has resulted. *Pseudacraea eurytus*, a butterfly related to our ' White Admiral ',

inhabits forested country over the greater part of Africa in an as yet uncounted number of forms, some bisexual, some confined to the male, others only female, but all very closely mimicking species of the genus *Bematistes* (*Planema*) in the same locality. In areas where the models are relatively very scarce the *Pseudacraea* shows great variations.

The genus *Charaxes*, predominantly African, was also a great favourite of Poulton's and he revealed very complex mimetic relationships within the genus itself.

As a whole-hearted Darwinian Poulton was especially attracted by the problem of sexual selection, and it was largely owing to him that so much work has been done in the field and laboratory on the structures, to which Fritz Müller first drew attention, for producing scent in male insects. The late H. Eltringham showed to what a degree of complexity the structures have been developed, and their use in the field has been observed by Poulton's correspondents.

Beside the two books already mentioned Poulton wrote two on Darwin, interpreting simply the doctrines of evolution and natural selection. But most of his writing was for the publications of the Entomological Society, and a very great deal of time was given to correspondents, so that he never found time to produce the '*magnum opus*' foreshadowed in the preface to his 'Essays on Evolution'

Something must now be said of the man himself. His outstanding characteristic was a passion for accurate detail : he was almost quixotically truthful, as when he told the writer that he did not approve of fairy stories, for the child would eventually learn that they were not true. No trouble was too great for him to take to establish some truth or correct some error. Pugnacious by nature, yet gentle and of real humility, he was always ready to listen to a worthy argument, but could not tolerate slipshod work or superficially based and ignorant criticism. Most generous in acknowledging help from others he would bring forward some quite trivial observation to encourage a young or diffident naturalist. Like many generous men he had absurd petty economies and never bought paper on which to write but with scissors and paste would piece together bits of documents, advertisements, etc., or use the backs, and produce the most amazing sheets of MS. with extra tags gummed on to the edges—a printer's nightmare ! He had no head for mathematics and the intricacies of genetics and statistics did not appeal to him. Music was outside his scope, but he loved poetry. Very vigorous in young manhood he rode for Oxford in the inter-University cycle races and was probably the last Oxford survivor of these long discarded events.

Social gatherings meant a great deal to him : he had been President of of the Union at Oxford and made close friendships with many men of science. He regularly attended the meetings of the British Association and went with it to South Africa and Australia. He married Emily Palmer in 1881 and their hospitable house at Oxford, and holiday home in the Isle of Wight, saw very many friends. They had five children, but sustained sad losses from 1909 onwards and only Mrs Maxwell Garnett survives.

Lady Poulton died in 1939 and he aged very quickly afterwards : his memory weakened and the end came mercifully after a few days of gradual

heart failure. Thirteen grandchildren and six great-grandchildren, survive him.

Many honours and distinctions came to him. The Linnean Society made him President 1912–16 and awarded him its Linnean medal in 1922. He represented the Society in 1907 in Sweden for the bicentenary of the birth of Linnaeus. The Royal Society made him Vice-President in 1909–10 and he twice served on the Council: the Darwin medal was awarded in 1914. He was President of the Association of Economic Biologists 1922–23; of the South-Eastern Union of Scientific Societies in 1921, and of the British Association in 1937. He presided over the second International Entomological Congress at Oxford in 1912 and gave the Romanes lecture in 1915.

The Entomological Society of London owed very much to his activities and made him President three times, the last occasion being the year of its centenary, 1933, when it received a 'Royal' title and elected him Honorary Life President.

He was knighted in 1935 and in 1916 was made a Foreign Member of the Swedish Academy of Science. He was Commander (Class II) of the Swedish order of the Pole Star. Honorary degrees were conferred upon him by Princeton, Durham, Dublin and Reading Universities: he was D.Sc. of Oxford and Sydney and Honorary member of the New York Academy of Science, the Entomological Society of Belgium and the Spanish Royal Natural History Society. G. D. Hale Carpenter.

Sir David Prain (1857–1944) was born in Fettercairn, Kincardineshire. His father's family had lived in the country between Perth and Dundee for at least two centuries; his mother came from the Vale of Don in Aberdeenshire. Away back in the seventeenth century on his mother's side there was an ancestor of note, John McOmie, Mor of Fortar in Glen Isla, whose efforts to curb the predatory lawlessness of the glens earned him enmity enough to compass his ruin. Prain's father's ancestry were people of rural occupations—farming, flax-raising, village weaving, etc.; great-uncles and the like had adopted teaching or had entered the ministry, and his father had intended to teach but turned to business.

Prain went to the Fettercairn Parish School, then under an exceedingly competent teacher, Archibald Cowie Cameron. From him he got an abiding interest in history and geography and a good grounding in the normal subjects. At 15 he proceeded to the Aberdeen Grammar School because he had arranged to enter the service of the Royal Bank of Scotland and the Bank required its clerks to have been for a year at such a school. At the Grammar School he did well, was a prize winner in the class immediately below the top and was awarded also a prize in Natural History or, may we say, in knowledge obtained from observation whereas the other was from instruction.

Prain would have forthwith entered the Bank and sought a transfer to the East later as did a class rival of the Fettercairn School who ended his active career as Manager of the Hongkong branch of the Hongkong and Shanghai Bank; but Cameron intervened. He had been asked by Sir Alexander Ramsay, of Balmain, who had property in Fettercairn, to name lads of the neighbourhood who would do credit at a Scotch University to

two bursaries in his gift, and Cameron determined that one should go to Prain. Prain, mindful of his age and position at the Grammar School in a class below the top, would have adhered to his first intention ; but home influence and a visit to Aberdeen by the dominie for no other purpose than to win his point, sent Prain to the University in October 1873. Then followed four difficult years of search for the right road to a teaching career, wherein his studies were broken by three spells as a schoolmaster, two at his old school in Fettercairn and one at a school in Cornwall ; and when he came to know well that his best chance of honours was in Natural Science, with Botany his chief subject, he still doubted if the subject led direct to employment. The M.A. with Honours, however, was earned in 1878 ; and for the next two years he held a mastership at Chatham House School, Ramsgate.

At Aberdeen his teacher in Botany had been J. W. H. Trail, elected professor just in time for Prain to attend his classes ; and Trail, because the classes counted as time towards a medical degree, caused Prain to register as a medical student, which he did without any intention of proceeding to a qualification in Medicine. But when he found at Ramsgate that he could save out of his salary enough to venture, he returned to Aberdeen in the fall of 1880, and by two years there, followed by one in Edinburgh, he graduated at the latter place as L.R.C.S. and L.M., and at the former as M.B. and C.M., with the highest honours.

While studying in Edinburgh he had served as Assistant Demonstrator in Anatomy at the Royal College of Surgeons, and when he had taken his degrees in Aberdeen, the Professor of Anatomy appointed him Junior Demonstrator. Shortly afterwards the University Court gave him the post which fell vacant of senior Demonstrator. He had wished rather for a post of House Surgeon ; but one did not come his way. Trail, on the suggestion of Brigade-Surgeon (afterwards Sir) George King who visited Aberdeen on leave from his post in Calcutta, put it to Prain that there were gates into botanical work from the Indian Medical Service ; and Prain therefore applied for that service, sat in the competitive examination in August 1884 and came out top. He went to the Royal Military Hospital, Netley, and was sent out to India by troopship early in the next spring. Entrants into the service must expect a period of two years in cantoonments ; but his two years were unexpectedly broken, for Lewis J. K. Brace, Curator, under King, of the Calcutta Herbarium and Librarian, was unexpectedly taken so ill that he had to be sent out of India on sick leave, and Prain's services were then lent to the Government of Bengal that he might act in Brace's place. In this way his first botanical post came to him at the age of almost 28. When Brace returned, Prain reverted to military duty and was sent to Kohima in the Naga Hills in medical charge of a Gurkha regiment, and there he made excellent use of opportunities for botanizing that this interesting centre offered and of studying the Angami Nagas of the hills. Brace's health again broke down, and in January 1887 Prain was sent back to Calcutta to be the permanent occupant of the post which Brace had had. This post he held until early in 1898.

Prain's scientific output during the eleven years, 1887–1897, was considerable. He wrote a series of taxonomic papers entitled ' Noviciae Indicae ', being descriptions of new Phanerogams detected in the Herbarium

of the Garden or cultivated in its observation grounds; he studied Papaveraceae, Leguminosae, *Pedicularis* in the Scrophulariaceae and *Gomphostemma* in the Labiatae, etc.; and he gave rein to two major interests—the phytogeography of eastern lands and the uses of eastern plants. Taxonomy and Phytogeography were routine employments in the eyes of Government, but not so the uses of plants; and the Government of Bengal, with King's approval, asked of him a report on the cultivation and harvesting of Indian Hemp which kept him for some time in the villages where *Cannabis* growing is permitted. His recommendations, both fiscal and social, were at once accepted by the Excise Department in Bengal and by a Hemp Drugs Commission then sitting. Next the Department of Land-Records and Agriculture, Bengal, asked him to classify the wheats of the Province, and having collected all the kinds which the villagers named, submitting them, provided land where he grew and studied them in all stages. This was followed by a like study of the Mustards and of the pulses, and later of Indigo.

During these years when he was Curator he travelled considerably, visiting many islands in the Bay of Bengal and many parts of northern India. His papers on the Bay islands have a distinct phytogeographic interest.

In 1897 the health of Sir George King gave way, and Prain in 1898 succeeded him as Superintendent of the Royal Botanic Garden and of the Cinchona Department. From the time of Wallich, the Superintendent of the Garden had been Professor of Botany in the Medical College, Calcutta. This had been a duty of King's and was a duty of Prain's henceforward, but actually he had taken over from King in 1895. He was made a Trustee of the Indian Museum at once and in 1900 a Fellow of the University of Calcutta, in which capacity he had his place on its very active Senate. He was also, in succession to King, Director of the Botanical Survey of India.

Sir Joseph Hooker, in 1887, in a valedictory preface to volume seven of his 'Flora of British India' foreshadowed the issue of Indian Provincial Floras and, Britain having done its part by putting all its information into Hooker's work, obviously expected of the Calcutta Garden that it would take up the Flora of Bengal.

Prain accordingly wrote his 'Bengal Plants' and printed it at his own cost in 1903. To find time for the work had not been easy; indeed he wrote it in unofficial time, on holidays and even when unwell. In the next year he published, *inter alia*, his monograph on the species of *Dalbergia* of south-eastern Asia and in the year after his scrupulously exact 'Life of Francis Hamilton (once Buchanan)'.

A long-continued slump in world prices of quinine kept him perpetually on the watch and anxious regarding the financial side of the Cinchona Department, but he met the situation with great business aptitude and earned official commendation. In the progress of the Calcutta Garden he met with one set back; he had expectations of being given laboratories for work on the Cryptogams and Dr. (afterwards Sir) Edwin Butler had already been stationed at the Garden when those in charge of health declared against the situation, as indeed it must be admitted they were entitled to do, since the outskirts of Calcutta are malarious.

An officer with large responsibilities such as his finds it hard to travel, and while he was Superintendent he saw less of India than he had as Curator; but in 1903 he contrived to join the Lhasa Expedition when at Khambajong, for a hurried visit. He travelled thither in company with Captain H. J. Walton, I.M.S., who served through the whole expedition and continued the plant collecting after Prain had returned. Prain brought in the end of 1904 all the Sikkim-Thibet frontier collections of the Calcutta Herbarium to Kew and had made not a little progress towards a report on them when his appointment to the post of Director of the Royal Botanic Gardens stopped this work. The report is still unwritten. Someone may take the work up now and seek to know the season of Prain's journey. It was from mid-September to mid-October. He crossed the Kongralama Pass on 23 September and encountered at it the first winter snow: but the air beyond was dry and crisp and there were still flowers enough at Khambajong to fill his whole day with the work of collecting them.

It is known to the writer that Prain's name had been mentioned as early as 1895 in very influential quarters in connection with the administrative staff of the Royal Botanic Gardens, Kew; but his presence at work there in 1905 had nothing whatsoever to do with his succession to the Directorate at the end of that year; it merely happened that leave had become due and he was taking it, and making use of the opportunity to elaborate certain families for Sir George King's 'Materials for a Flora of the Malay Peninsula' as well as to work up the Thibetan collections. The succession when it abruptly stopped his Indian work, threw him into work on African plants, because great efforts were being made at Kew to complete the 'Flora Capensis' and the 'Flora of Tropical Africa'. He contributed to both Floras. They remained under the editorship of Sir William Thiselton-Dyer, the first until completed, the second until the breakdown of Sir William's health in 1915 when it passed to Prain. He wrote much for the 'Kew Bulletin', edited and contributed to Hooker's 'Icones Plantarum' and 'Curtis's Botanical Magazine'; and the 'Index Kewensis' being in his charge he made the great but inevitable change of excluding the nomenclator part of its original plan, and with characteristic wisdom refused to allow supplementary pages to be appended to the Supplements.

During Prain's directorship, Museum No. 4 (timbers) was opened to the public and there was a very advantageous transfer to the Herbarium from the Kew Museums of purely botanical exhibits.

The war depleted his staff and raised for him many difficulties; but during it he contrived to establish a temporary laboratory in a house, between the Gardens and Kew Green, where plant diseases, both those of vegetable and those of animal origin, were dealt with.

He had not been Director for many weeks, when the Trustees appointed in the will of John Innes, of Merton, approached Kew for advice in founding the School of Horticulture provided for by the will. The Royal Gardens being already a school of horticulture this was natural. From the date of their approach to the last months of his life he was a pivot in the building up and administration of that new school—a research school, the John Innes Horticultural Institution, and when it came into operation in January 1909 he became Chairman of its Council and remained so for thirty-five years.

Botanists have great cause for gratitude for his long and admirable service.

He was not much less *in loco parentis* to the Imperial College of Tropical Agriculture in Trinidad, West Indies. The College was founded in 1921 as a development of agricultural work in the British West Indies begun by Sir Daniel Morris in the 'nineties and continued by Sir Francis Watts. The College buildings were opened in October 1922; but Prain had been on Government committees which led up to this from as far back as 1909. He became Vice-chairman of the Governing Body in September 1921, and succeeded Sir Arthur Shipley as Chairman in 1927.

The Government at home made great use of him in committees, particularly from the year 1910 on such as were connected with research in Biology and kindred technologies. Several of these committees did preparatory work for the far reaching reforms in national education which passed through Parliament during the War and afterwards.

Another public service for which he should be remembered lay in work he did for the Society for the Promotion of Nature Reserves and in the National Trust for places of Historic Interest or Natural Beauty. This began in 1918 and continued to 1932.

In 1924 he was elected a Trustee of the British Museum in succession to Sir Archibald Geikie.

Prain became a Fellow of the Linnean Society in 1888 and attended meetings when on leave in Britain. In 1894 he addressed the Society on the morphology of the flower of Cannabis and in 1905 on a new subfamily of the Sterculiaceae. He was elected to the Council from 1906 to 1910 and to the Presidential Chair from 1916 to 1919, difficult years owing to the War—years in which the Society lost in numbers and had to inspect closely its affairs. His first presidential address, that of 24 May 1917, was mainly on the subject of State-stimulated Research. He chose the subject manifestly because of his pre-occupations in government committees bearing on advanced education. The address, *vis-à-vis* the Society touched on matters too seldom thought about—what the Linnean Society is and whither its destiny? The Society, he pointed out, came into being at a period when the words Botany and Zoology connoted the Natural History of Plants and of Animals respectively: its charter bade it and still bids it collect knowledge in subjects of Natural History in all its branches and the bye-laws enjoin that the knowledge be recorded: the period of its birth was one of accumulating foundations, a period when Botany and Zoology progressed *pari passu* in double harness and Fellows of the Society were as often Naturalists without denomination as botanists or zoologists. Progress has changed the limits of the two sciences; Botany is Natural History of plants along with all that appertains to the growing and metabolizing plant; but Zoology remains the Natural History of animals, and in spite of its academic bias towards a comparative anatomy does not cover the subject of the metabolizing animal. This element of cleavage has secondary effects in that Botany has drawn nearer than Zoology to its technologies. The Government, he pointed out, in the stress of circumstances had decided to put science into its own harness, was asking for research which it classified into Scientific Research and Industrial Research, the difference one may suggest mainly degree of nearness to pecuniary profit. With these intentions abroad, he recommended Fellows to a

consideration which indeed is as profitable to the Society now as it was then. The greatest strength of the Society is where Botanists and Zoologists have common ground, and Plants and Animals offer interrelations for study.

His address of 24 May 1919 also touched on administration, but was more domestic. It was a timely exhortation to Fellows who had joined that it was expected of them that they should incorporate themselves fully. At the end of it he launched the Goodenough Fund. Do we call enough attention to our 'obligation'?

Linnean Presidents invariably look back in their annual address on the closing year, and some have thought that the whole address should be devoted to this. Prain, more than any other, definitely looked also into the future.

Prain was elected a Fellow of the Royal Society in 1905, to its Council from 1908 to 1910 and to be Treasurer from 1919 to 1929. He was President of section K (Botany) of the British Association at the Winnipeg meeting (1910). He was President of the South-eastern Union of Scientific Societies at their Folkestone meeting in 1912; Vice-President of the Ray Society in 1918; Vice-President of the Gilbert White Fellowship in 1918 and became President from 1921 to 1924; he was President of the Association of Economic Biologists in 1919, of the Bournemouth Natural History Society in 1920, of the Imperial Botanical Conference in 1924; a Vice-President of the Royal Horticultural Society from 1919 to his end and President of the Essex Field Club from 1930 to 1933.

Three score scientific societies had invited his honorary membership.

After he had done what he regarded as his duty by the African floras, he was able to give an increasing amount of time to the study of plants of economic interest and he brought to bear on their histories an impressive scholarship. His writings on rubber, cinchona, turnsole, the Jerusalem Artichoke, heliotrope and yams are full of human interest. The Yams had been brought to his attention as early as 1895 and he happily lived to round off his work on them.

Retirement at the age of sixty-five from the post of Director of the Royal Botanic Gardens, Kew, altered his activities somewhat, not however, as with many men, sending him deeper into book study; but giving him other administrative activities. He drew possibly a little further into matters of forest produce, and in 1925 he became Chairman of the Advisory Council for Vegetable and Animal Products at the Imperial Institute. This he retained until 1934.

In 1932, being seventy-five, he began to feel his years and resigned from some of the Committees on which he had a place. In 1934 he felt it necessary to lay down a little more and ceased his regular attendance at the Imperial Institute. In 1936 he retired from the Governing Body of the Imperial College of Tropical Agriculture. The handicap of deafness appeared. In 1942 he lost his wife and this ushered in the end. He died suddenly on the morning of 16 March 1944 when attempting to dress himself after a short illness with two days in bed.

It remains to name some of the honours which came to him:—LL.D., from the University of Aberdeen, 1900; C.I.E., 1906; Knight of the Royal Swedish Order of the Polar Star, 1908; Barclay Memorial Medal from

the Asiatic Society of Bengal, 1909; LL.D., from the University of St. Andrews, 1911; C.M.G. and Knight-Bachelor, 1912; Victoria Medal of Honour from the Royal Horticultural Society, 1912; Commander of the Order of Leopold II., 1919; Albert Medal of the Royal Society of Arts, 1933; a Veitch Memorial Medal from the Royal Horticultural Society, 1933; the Linnean Medal from our Society, 1935; and the Johannes Bruhl Medal from the Royal Asiatic Society of Bengal, 1938.

I. H. Burkill.

Professor Joseph Hubert Priestley died at Leeds on 31 October 1944, aged sixty-one. He was the son of J. E. Priestley, Headmaster of Tewkesbury Grammar School, and was born at Tewkesbury in 1883. A younger brother was Dr. R. E. Priestley, a geological member of Shackleton's 1907–09 Antarctic Expedition and of Scott's 1910–13 Expedition, who is now Vice-Chancellor of the University of Birmingham. J. H. Priestley received his education at Tewkesbury Grammar School and at University College, Bristol, becoming a graduate of London University. Soon after graduation, in 1905, he was placed in charge of the Department of Botany at Bristol, and then, in 1911, he succeeded V. H. Blackman as Professor of Botany in the University of Leeds. In this year, also, he married Marion E. Young, of Cotham, Bristol, who, with two daughters, survives him. He became a Fellow of the Linnean Society in 1908.

At Bristol, Priestley had collaborated with F. L. Usher in investigating the mechanism of photosynthesis, both with the idea of establishing or refuting the formaldehyde hypothesis as well as with the hope of studying *in vitro* the role of the pigments. He continued this work at Leeds, where, with Ingvar Jorgensen, he also turned his attention to a pioneer investigation of the effects of electrical discharges on field crops. He was at this time in command of the Leeds University Officers' Training Corps, and on the outbreak of war in 1914, he, as a captain, went to France with the British Expeditionary Force. From 1915 to 1919 he served in France on the Staff (Intelligence), being twice mentioned in dispatches and awarded the Distinguished Service Order and the Croix de Chevalier de la Couronne de Belgique.

The end of the European war marked for Priestley the close of one era and the beginning of another. He belonged to none of the existing schools of botanical thought. Scientifically he was almost self-trained and quite without the long discipline in a particular technique which was then habitual. His thinking about the earlier experiments with field crops had decided him to devote himself to the detailed consideration of plant growth, and this, for the first year or two, he did, publishing papers on the growth of roots from cuttings and on more general aspects of the problem. Soon, however, he became profoundly impressed by the philosophical outlook of W. H. Lang, and his work rapidly crystallized into the series of studies in causal and developmental morphology that became his main contribution to the botanical thought of our time. His attitude was simply that the form and structure of a tissue or organ is the result of the growth processes that formed it, and these he attempted to analyse by detailed studies of the organization of the developing tissues.

The next ten years were a period of tremendous activity; papers, either alone or in collaboration, were published on the development of the endodermis and the significance of certain variations in its type and position, on the fatty deposits (cutin and suberin) in cell walls, on the cell walls of meristematic tissues, on the healing of wounds and on vegetative propagation (Masters Lecture to the Royal Horticultural Society, 1925), and, finally, on light and growth and the developmental interpretation of etiolation. Running through all these subjects were certain scientific pre-occupations, the conviction that cell wall structures could be used to find out more about the cells that formed them, the conviction that regeneration must normally be related to the presence of potentially meristematic cells in the propagule, and, above all, a continual return to the problem of the re-initiation of growth in mature cells, e.g., in cork cambia and cuttings. It was almost inevitable that Priestley should come finally to the detailed consideration of the vascular cambium and that when, in 1932, he delivered his Presidential Address to Section K of the British Association at York, he should concern himself with the activities of this cambium in trees. Thereafter, this was to be a main pre-occupation. It led him to a productive interest in the work of the Forestry Commission, and, scientifically, to the detailed investigation of spiral grain in timber, work which was still largely unpublished at his death. His interest in apical meristems became focused particularly on development in monocotyledons and on the problems of the procambium.

This intense scientific activity was paralleled by equally vigorous administrative and social interests. Priestley had great administrative capacity, and was more than once pressed to take over principal administrative posts, but his scientific work bulked so largely in his interest that he refused to leave it for administration. He was almost an automatic choice for any University Committee of importance. For long the academic member of the Finance Committee, for four and a half years Pro-Vice-Chancellor, he was also a prominent member of the Joint Matriculation Board of which he served as Chairman. His interest in the social life of the University was equally great, for he fostered a Staff Social Club, was a founder and leading exponent of cricket, bandy and badminton clubs, as well as an excellent and enthusiastic dancer. There was one other field in which he took a great personal interest—the activities of the local naturalists, and particularly of the Yorkshire Naturalists' Union, of which he was President in 1925.

Much of Priestley's success as an administrator and executive was due to the speed with which he seized upon the essential point at issue and formed an opinion on it. With this gift, a fluent tongue and a great interest in persons, he was almost bound to be an excellent teacher, and his freedom from academic and scientific tradition made him an original and inspiring one. In his younger days he could be shatteringly naive to those trained in one of the traditional schools of botany. Naive, because he ignored so much that had been accepted; shattering, because he almost always led one to revalue the facts. He was outstanding in discussion, where his personality and the quickness of his mind had their full play. To a great extent his writing reflected similar features.

His style was essentially personal and very often that of the advocate. Like an advocate, he was inclined to make much of the telling fact at the expense of detailed and precise description. To some extent this was due to the pressure of other duties and interests, but he was by temperament less suited to the patient marshalling of massive data. Nevertheless, it would be wrong to suppose that the investigations themselves lacked either thoroughness or scope. His own criticism of his work (and a just one) was that he had always been in charge of a department and so busy with teaching and administrative duties that he had only been able to carry out research through the hands of others. This meant that he was quite capable of dismissing two years' work in as many pages, but, on the other hand, it gave him a certain scientific detachment. One may add that he had been absent on military service for four and a half vital years. For those who returned to scientific life, that experience certainly allowed of a casting off of preconceived ideas and led to a deepening of the channels of individual thought. In this, Priestley was the child of his time. He was, perhaps, more sensitive to the effects this experience produced, because his training had been achieved largely in isolation. Hence, in one field of botanical thought, at least, he represents more fully than any other the re-orientation in scientific outlook which followed the last great war. W. H. Pearsall.

The tragic death of Douglas Raitt on 4 October 1944, as the result of a car accident, came as a shock to his many friends and robbed fishery research of a very promising worker.

Born in Aberdeen on 18 January 1903, and educated at Robert Gordon's College, he entered the University as a science student in 1920, taking his degree in 1926. Here he came under the stimulating influence of Prof. J. Arthur Thomson, and turned his attention to zoological studies. Appointed in 1926 to the scientific staff of the Fishery Board for Scotland, he took part in the investigations on haddock which had been initiated by the then Scientific Superintendent, the late Dr. Alexander Bowman, and brilliantly executed by Dr. Harold Thompson. Raitt's fishery publications dealt mainly with this important fish, beginning with a paper on the 'Fertility of the Haddock'. When Dr. Thompson left to organize fishery research in Newfoundland, Raitt was put in charge of the haddock work, including the preparation of the forecasts of the future yield of the fishery which formed such a striking and valuable feature of the Scottish fishery investigations. He published several memoirs on the subject in the Scientific Investigations of the Fishery Board and in the Reports and Journal of the International Council for the Exploration of the Sea. In the latest of these, a paper on 'The Rate of Mortality in the North Sea Haddock Stocks', published in 1939, he made a valuable contribution to the over-fishing problem. As a side-line, he made a particular study of the sand-eels, and established the existence of a new British species.

He gained his D.Sc. in 1937, became a Fellow of the Linnean Society in 1935, and of the Royal Society of Edinburgh in 1936. He was appointed Buckland Lecturer for 1940, but the outbreak of war prevented the delivery of the projected series of lectures on the haddock.

During the present war he was seconded to the Ministry of Home Security and served with distinction under the District Commissioners at Inverness, Edinburgh and Dundee.

Apart from his scientific activities, Raitt had many other interests, and lived a full life. He was well known as a broadcaster and a composer of Scottish songs, and he was in the best sense of the word a good showman, having a great gift for the staging of fishery exhibitions, and the production of films on fishery subjects. He had an attractive personality and made numerous friends, who all deplore that early death should have cut short the brilliant career opening before him. E. S. Russell.

The death of Professor William Albert Setchell at Berkeley on 5 April 1943 removes not only a distinguished Professor Emeritus of the University of California but a figure who for many years has been the leading algologist in the American continent. During his visits to Europe he spent much time in the herbaria of Kew and of the British Museum, and marine botanists in this country feel his death as a deep personal loss.

Setchell was born at Norwich, Connecticut, on 15 April 1864. He entered Yale University in 1883 and though a member of the classical course he came into contact with D. C. Eaton, who was Professor of Botany and who encouraged him in his interest in botany, including Cryptogams. In his Senior year he had decided on cryptogamic botany as an avocation. He proceeded to Harvard in 1887 where he came under the influence of that great cryptogamist W. G. Farlow and took his doctorate there in 1890. After holding assistantships both at Harvard and Yale, Setchell was called, in 1891, to the University of California to become Professor of Botany and Chairman of the Department, posts which he continued to hold for upwards of forty years.

Although Setchell published papers on flowering plants and a number on the fungi, his main interests throughout his long career were the taxonomy of the marine algae of the Pacific Coast and the biological and distributional problems of the vegetation. Before he left Yale he had begun work on the Laminariaceae, and it is not surprising that the giant kelps of the Pacific, which form such a stupendous feature of the marine vegetation of California, absorbed his interest from the time of his arrival at Berkeley. On this group he published several monographic studies, the last forming a contribution to an important Senate Document entitled 'Fertilizer Resources of the United States'. Setchell had published jointly with N.L. Gardner a treatise on the North-West American algae in 1903, but in 1919 the two authors again collaborated in a much more comprehensive and critical work entitled "The Marine Algae of the Pacific Coast of North America'. Three parts out of the four which were planned were published: Part I., Myxophyceae, appearing in 1919: Part II., Chlorophyceae, in 1920, and Part III., Melanophyceae, in 1925. The work was copiously illustrated and the text of the three Parts occupied nearly 1,000 pages. It was greatly regretted by all algologists that Part IV., dealing with the Florideae, never appeared.

Another important service Setchell rendered to his chosen branch of botany was the circulation of a fine set of exsiccatae 'Phycotheca Boreali

Americana ' compiled by himself together with two amateurs, F. S. Collins and Isaac Holden—a series which ultimately ran into 2,375 numbers (actually over 3,000 specimens), and which has been much valued by taxonomic institutions on both sides of the Atlantic.

Two world tours were included in Setchell's many travels. During the first (1903–4) he was interested in taxonomy and apart from collecting wherever he could he worked chiefly in herbaria, and during the second (1926–27) he had a wider outlook and studied such problems as insular floras, coral-reef formation and seaweed distribution in relation to water temperatures. In 1929 he published an important paper on Zostera.

Setchell visited England four times and enjoyed his stays at Kew studying type specimens and the old Pacific collections, whilst he invariably gave the institution the benefit of his own critical identifications. His ideas on distributional problems, though not entirely orthodox, were stimulating, and owing to his first hand experience with so many of the problems his views were always interesting and worthy of consideration. His taxonomic work on the north-west Pacific flora, especially the revisions, was good, though there was always a tendency to ' split ' and this persisted to his later years, which, in view of the increasing range of his experience, was somewhat surprising.

Setchell took an active part in the administration of the University, and he was one of those, Dr. T. H. Goodspeed tells us, ' who interpreted the academic traditions of Harvard and Yale in terms of Western ideals and aspirations '. He was very popular with the staff and beloved by his students, to whom he was most good. His wide interests, which included music, literature and the fine arts, were attributable very largely to the two years that he was able to spend at Harvard after graduation.

Setchell was elected a Foreign Member of the Linnean Society in 1939. His last visit to England was in 1935, when he also attended the International Botanical Congress at Amsterdam. At the Congress he was clearly not in good health, but he gathered round him his old friends and much enjoyed discussing old and new problems and entertaining them once more with all his characteristic generosity. A. D. Cotton.

Dr. Tom Stansfield did much for the culture and love of English ferns. At one time there were many who grew the elegant, plumose and grotesque crested varieties of the ' male ' and ' lady ' ferns, but fashions in gardening changed and the great collections were left in the hands of a tiny band of faithful enthusiasts. For years Dr. Stansfield had contributed to and edited the ' British Pteridological Journal.' It was a privilege to see his garden, where he contrived with trellis shelters to modify a rather hot summer into a climate where ferns could grow fronds of very great beauty. He was elected a Fellow of the Society on 24 Nov. 1938. T. M. Harris.

Colin Fraser Symington, who died in Nigeria on 9 September 1943, was born at Edinburgh on 3 November 1905. He was educated at George Watson's College, Edinburgh and at Edinburgh University, where he took his degree B.Sc. (Forestry). After leaving Edinburgh he took a post-graduate course at Oxford University and on the completion of this was appointed in 1927 to the Malayan Forestry Service. He made rapid

progress in this service, and for some years up to the outbreak of war in Malaya, had been in charge of the Botanical Research Institute at Kepong. In connection with his work he travelled widely in the East, visiting the Philippines, Borneo, Sumatra, etc. He was elected a Fellow of the Linnean Society in 1940.

When the war began to touch Malaya, Symington sent his wife and children to Melbourne. In the early days of the invasion he acted as guide in the jungle to British and Australian troops. Later he and one of his forestry colleagues recruited and led a force of Chinese guerrillas. After the capitulation of Singapore he and a few others escaped in a Chinese junk and landed in the south of Sumatra. He eventually reached Australia and after a time was posted by the Colonial Office to the Forestry Department, Nigeria, leaving his wife and family in South Africa.

Upon taking up his new appointment in Nigeria, Symington threw himself into the work with his usual energy and enthusiasm. In the last letter received from him, dated 9 April 1943, he wrote : ' I am enjoying Nigeria very much. The flora, of course, is very much poorer than Malaya, but there is plenty of interest in it for a new-comer. The ecology of the country is more interesting, but so far I have not been about much. My time has been full organizing the herbarium and forest botany generally and teaching the forest school. Both are intensely interesting. . . . The school, which has some students up to degree standard, gives me the opportunity of corrupting the young with my revolutionary ideas as to how tropical botany should be conducted '. But as a result of his experiences in Malaya, his health was undermined, and within six months he succumbed to a severe attack of malaria and dysentery.

Symington will long be remembered for his work on the Dipterocarpaceae. This important family of timber-trees formed the subject of a valuable series of papers from his pen, published in the ' Gardens' Bulletin, Straits Settlements ', from 1933 to 1939. Concurrently with these, he was working on a ' Manual of Malayan Dipterocarpaceae ', the completion of which he effected just before the fall of Singapore ; it was with great satisfaction and relief that one learnt that he had managed to bring away a complete proof copy with him in his hazardous escape at the time of the Japanese occupation.

A glance through his papers on Dipterocarpaceae mentioned above, and perhaps even more the eventual perusal of the ' Manual ', will reveal something of the magnitude of the loss that botany has sustained in the death of such an outstanding worker at the tragically early age of thirty-eight. The present writer finds it difficult to speak of Symington's ability in moderate terms. As a field botanist and as a taxonomist he was brilliant : his amazing ' eye ' for plants placed him, in this respect, in a class by himself. The opportunity was often taken of his visits to the Kew Herbarium to ask his opinion upon the identification of baffling specimens from the Malay region, and not only was he rarely at a loss to suggest a determination, but he was never found to be wrong.

To the present writer, Colin Symington was in truth a ' kindred spirit ' and a well-loved friend, and the contemplation of a life and career that had already achieved so much, and promised even more for the future, thus cut short in its prime, fills one—even in the midst of a war that has made

such things almost commonplace—with a sense of irremediable loss. The deepest sympathy is extended to his parents, widow and two small children.

KENNETH AIRY SHAW.

By the death of Dr. E. N. MILES THOMAS in August 1944 the Linnean Society has lost one of its earliest women Fellows. Elected in 1908, she served on the Council (1910–1915) and contributed to its records (Proc. Linn. Soc. 1923) as well as to discussions at the Society's meetings on a variety of occasions.

A student of University College, London, she also attended lectures at the Imperial College of Science by Prof. Farmer, which proved especially stimulating. Her interest in anatomical problems had already been aroused by her contacts with Miss Ethel Sargent, F.L.S., and with Mr. (later Prof.) A. G. Tansley. She fully appreciated the importance of the work of Guignard, in France, whose announcement of 'double fertilization' in the angiospermous embryo sac had aroused much interest, and she was the first in this country to confirm and extend his results by her observations on the same phenomenon in *Caltha palustris* (Ann. Bot., 1900). Subsequently, problems of seedling anatomy claimed her attention. It is characteristic that, although she was for some time research assistant to Miss Ethel Sargent, who was at that time concerned with contrasting the seedling anatomy of monocotyledonous and dicotyledonous types, her own researches developed along very different lines towards conclusions in a wider field. Her name is especially associated with the theory of the 'double leaf-trace' ('New Phytologist', VI, 1907), founded on a consideration of a large number of angiospermous and gymnospermous types. She had in mind the development of an interpretation of seedling anatomy on an equally broad foundation, and her own work, as well as that of her research students, was mainly directed towards this end, but pressure of circumstances and failing health prevented her from formulating a considered statement embracing the whole field which had been explored. She was fully aware of the changing view-point of the last decades, and intended to take account of this more dynamic outlook without losing sight of the older phylogenetic and systematic aspects which still held her interest.

Dr. Thomas was also a distinguished University teacher, sympathetic towards any who had a spark of interest in botany, or in research, and tireless in the organization and development of the departments with which she was associated, notably at Bedford College (1908–1916) and at University College, Leicester (1923–1937). She was also temporarily in charge of the botanical department at University College, Cardiff (1918), and acted as keeper of the department of the National Museum of Wales (1919–1921). In all these spheres she took a broad view of her responsibilities and was able to lay sound foundations for future developments.

The standards of teaching and departmental achievement at which Dr. Thomas aimed were high, her energy and enthusiasm unbounded, and it is perhaps not surprising that difficulties sometimes arose with those around, though often she was herself quite unaware of it. On

the other hand, she brought life and vigour into whatever she undertook, as the records which have survived her testify. One of her former students wrote: 'I think that the training Dr. Thomas gives . . . . possesses all those qualities which distinguish true education from mere teaching'. Some students apparently found it difficult to realize that to 'find one's own feet' is the best way even for examination results, and some of these wrote subsequently that they realized more and more the value of her method of training, which they had not at first properly understood.

In addition to the more strictly professional side of her work, Dr. Thomas retained many outside activities. She sought to interest schools and local societies in everyday problems of a biological nature. She took the greatest interest in the British Association for the Advancement of Science, and many will remember her vivacious presence at the social functions of this and other learned societies. After one such occasion, a reporter, describing her as one of England's leading women botanists, added with evident conviction 'and she dances like a moonbeam'. Her social qualities and a perfect grace of movement remained with her, indeed, almost to the end. A strong supporter of the feminist movement, anything to do with careers for women enlisted her sympathy; she was, however, especially interested in the promotion of research, and at one time had hoped to found an institute where this pursuit could be followed apart from the pressure of a teaching career.

Ambitious, yet courageous and steadfast in disappointment, warm hearted, even passionate, yet capable of a steely coldness, hasty at times, yet generous to a fault, Dr. Thomas was a striking but complex personality. She had many friends and her correspondence extended to all parts of the world. A short but very happy married life (as Mrs. H. M. F. Hyndman) crowned a notable professional career. Her husband's sudden death was a shock which precipitated the onset of loss of a memory which had long been too highly taxed. Warned of the likelihood that this must be an increasing handicap, she refused help from friends and relatives, preferring to face the inevitable alone. The end came as a release, but her life had been fully lived; she had 'warm'd both hands before the fire of life' and so was 'ready to depart'. E. M. Delf.

Robert Usher, M.A., F.L.S., F.Z.S., F.R.H.S., whose death occurred 22 June 1943, graduated at Corpus Christi College, Cambridge, taking his degree in 1889. After his ordination in 1891 by the Bishop of Llandaff he served as Curate of Cadoxton-juxta-Barry. Three years later he became Vicar of East Lulworth in Dorset and his clerical life was henceforth wholly spent in the Diocese of Sarum. During his first incumbency he became acquainted with the eminent Dorset naturalist, J. C. Mansel-Pleydell, who proposed his election as a Fellow of this Society on 1897. His especial interest lay in Cryptogamic botany, but his intense love of Nature led him to the study of the anatomy of Vertebrates and to the collection of Lepidoptera, in which he excelled. Leaving Lulworth in 1901, he became Rector of West Knoyle in Wiltshire, but returned to West Dorset in 1907 as Vicar of Netherbury, where he was still in touch with the Dorset Field Club, of which he was an ardent member. The

year 1912 saw him in town work as Rector of Marlborough and as Chaplain to the Forces during the war, three of his sons also obtaining commissions. In 1917 he was instituted Vicar of Barcombe and two years later Rector of Fovant, Salisbury. He was a man of quiet and unselfish zeal, a true Pastor and beloved by his large family and his many friends.

FRANCIS W. GALPIN.

Mr. WILLIAM PERCIVAL WESTELL, the Secretary of the Letchworth and District Natural History and Antiquarian Society for thirty years and Curator of the Letchworth Museum since 1914, died very suddenly on 1 November 1943 at the Museum.

Born at St. Albans 21 December 1874, he was educated at the Grammar School of that town and early decided upon authorship and lecturing as his career. On the 8 April 1907 he was elected F.L.S., and early in 1908 was attracted to Letchworth and in the same year became one of the founders of the Naturalists' Society. For a few years he was Natural Science Editor to Messrs J. M. Dent and Sons and was on the staff of two neighbouring schools. In the early days of radio he broadcast on Nature subjects and during his career was a member of the Society of Authors, on the Council of the Selborne Society and a member of the British Ornithologists' Union, the Society for the Promotion of Nature Reserves and referee in Ornithology to the South Eastern Union of Scientific Societies.

Writing of his work in the 'Journal of the Naturalists' Society', Lord Lytton, its President, in 1941 wrote: 'the fact that the Letchworth Museum is now quite an outstanding example of what a Regional Museum should be is due to the energy, enthusiasm and ability of Mr. Percival Westell. The whole district owes him a great debt of gratitude.'

During his life he was responsible for the authorship of over ninety, books on Natural History, his last volume 'Let's Watch the Birds' having been issued, late in 1943, by Messrs. Nelson. He also wrote 'Historic Hertfordshire' and many articles in Archaeological journals on the results of research in North Herts.

He helped to found the South Midlands Federation of Museums and was its Secretary-Treasurer.

In spite of his large literary output (it is estimated that over half-a-million copies of his works were sold) his energies were devoted in the main to his work at the Letchworth Museum. In 1925 a new impetus was given, in a new direction, to his thirst for knowledge. In that year an important Romano-British site was discovered at Baldock, two miles away. Here, with the help of a labourer and members of the Society, a cemetery was unearthed covering over three centuries of the Roman occupation from which over 300 burial groups (over 1,000 objects) were recovered and are now in the Museum. In 1929 at Wilbury Camp in Letchworth an Iron Age site with evidence of late Bronze Age occupation, was excavated and later two other local sites have been partially explored, besides several others contiguous, in all of which he was the leading spirit.

Two years ago he founded a Junior Section of the Naturalists' Society and was remarkably successful in securing the interest and loyalty of a large number of members. With their own officials, and under his presidency lectures were given regularly and exceedingly promising work done in many directions.

Although Ornithology was his first and abiding interest in nature study he was an all-round student and authority, and in his capacity as Curator the queries received and answered were constant and comprehensive. Nothing that grew or lived was outside his purview, and he was essentially a humanitarian, whose inspiration and help have contributed in no small degree to the interest and practical work in nature study and its expression in authorship and illustration of many others as well-known in the continually enlarging circle of Nature lovers.

It was natural that at the zenith of his powers he was a keen and clever cricketer, playing indeed until close on the age of sixty.

But such was the man, one who loved all life and lived to the full and whose decease was the cause of widespread regret. A. W. Brunt.

Sir Arthur Smith Woodward, Kt., LL.D., D.Sc., Ph.D., F.R.S., F.G.S. With the death of Sir Arthur Smith Woodward the world of Natural Science loses one of its most outstanding personalities and vertebrate palaeontology its leading exponent. He was eighty years of age and died on 2 September 1944.

He was born in Macclesfield, Cheshire, in 1864, the son of Edward Woodward, the head of a firm of silk dyers, and was not related to the distinguished family of naturalists of the same name, one of whom, Dr. Henry Woodward, F.R.S., he was to succeed as Keeper of Geology in the British Museum (Natural History). Educated at the local Grammar School, he early showed signs of a gifted intelligence and a marked love of natural history, and as a schoolboy made a large collection, mostly of fossils, from the neighbourhood of his home.

From school he went to Owens College, Manchester, where he studied for two years, but his academic career was cut short in 1882 by his appointment at the early age of eighteen to an Assistantship in the Department of Geology in the British Museum (Natural History).

His appointment occurred shortly after the transfer of the natural history collections from Bloomsbury to South Kensington, and his first duties lay in helping old William Davies, then in charge of the fossil vertebrates, to arrange the specimens in the new building. In that year, too, the great Egerton and Enniskillen collections of fossil fishes were purchased, and the curatorial work that they involved, requiring the examination and identification of thousands of first-class specimens, certainly provided a unique introduction to that group of fossils which was to be his major interest throughout life—an interest that was further stimulated by a series of Swiney Lectures delivered in South Kensington by Dr. R. H. Traquair, of the Royal Scottish Museum, whose novel ideas and modern outlook on taxonomy were ample compensation to the young enthusiast for the poorness of the lecturer's delivery.

Such was Smith Woodward's ability that four years after his joining the Museum staff he was entrusted with the writing of a catalogue of the collection of fossil fishes—a collection which was then, and still is, by far the finest and most representative in the world. This work was to occupy him for the next fifteen years, but by the time the second of the four volumes had appeared in 1891, only five years after the work was started, his reputation was established throughout the scientific world as one of the foremost vertebrate palaeontologists of the day.

This catalogue was no mere list of the specimens in the national collections, but a brilliant summary of current knowledge and original observation moulded into a classification that has been the basis of all taxonomic work on the group since that time. In order that his information should be as complete as possible, Smith Woodward travelled extensively both in this country and abroad to examine specimens in almost all the known collections, private as well as public—a list of collections visited made in 1891 details no fewer than ninety-two, of which thirty-six were on the Continent and twelve in America.

One of the most valuable features of this work was its accuracy, not only in the description of the specimens, but in the records of literature, all of which had been carefully studied, and that this monumental task should have been completed in fifteen years is an indication of the author's characteristically clear thinking and tireless industry.

Apart from general taxonomy, new results were not usually published in the Catalogue, for the author preferred to anticipate that work, and a constant stream of papers, numbering some hundreds, appeared during the course of its preparation in all the appropriate scientific journals and magazines. Nearly all these dealt with Mesozoic fishes, for the Tertiary faunas seldom provided material for interesting anatomical study, while the Palaeozoic was the preserve of Traquair—a preserve that was jealously guarded.

In spite of the demands that the Catalogue made on his time, Smith Woodward did not confine his researches to fossil fishes, but made original contributions to the study of all the vertebrate groups. Moreover, he also found time to write two other works of primary importance during this period—the first was the 'Catalogue of British Fossil Vertebrata', published in 1890 in conjunction with C. Davies Sherborn, while eight years later came the 'Outlines of Vertebrate Palaeontology', a work of much originality that was long to remain a standard book of reference for students.

In 1901, the year of the completion of the Catalogue, he became Keeper of Geology in the Museum, but the responsibilities of administration put little check on the flow of papers from his pen. Among the major works of this later period may be reckoned the classic memoirs on the 'Fossil Fishes of the English Chalk' (1902–12) and the 'Fossil Fishes of the English Wealden and Purbeck Formations' (1916–19), prepared for the Palaeontographical Society, of which he was for many years Secretary and afterwards President. He also found time to bring up to date and do part of the translation for the vertebrate sections of Eastman's English edition of Zittel's 'Text-book of Palaeontology' (1902) and revise and re-write much of the text for subsequent editions. Nevertheless, it will always be a matter of regret that the projected supplement to his Catalogue was never published. A certain amount of MS. and almost all the plates for the first volume exist, but the work was stopped by the first World War, and before the opportunity to continue it again presented itself, he had retired from the Trustees' service (1924)—and having retired, he never again entered the Museum's precincts.

Although the 'Catalogue of the Fossil Fishes' was his greatest contribution to Science, to the general public he became a world figure by

the discovery of the remains of Piltdown Man (*Eoanthropus dawsoni*). The first fragments were obtained in 1911 by the late Charles Dawson, an Uckfield solicitor, from workmen digging gravel at Piltdown, in Sussex. Dawson brought them to Smith Woodward, who at once recognized their importance, and thereafter the two men searched tirelessly for years to find the missing parts of the skull and the associated lower jaw—indeed, after Dawson's death, Smith Woodward, who had gone to live at Haywards Heath on his retirement, continued the search until his sight failed him in the last few years of his life. At first their efforts were rewarded and a description was published in 1913. When unearthed the skull had, apparently, been complete, but the labourers, thinking it of no value (Smith Woodward always declared that they had mistaken it for a coconut), had smashed it up, and to this day there is no contact between the major pieces, so that the exact form of the skull remained a matter of opinion. Smith Woodward's reconstruction was strongly assailed by the human anatomists and a world-wide controversy ensued, not only in scientific circles but in the public press, and even the more primitive religious bodies brought their guns to bear on the hapless author. At first, moreover, the attribution of the lower jaw to the same animal as the skull was questioned in some quarters, but this doubt was settled for all but the most intransigent by the discovery of a lower canine tooth of a type that emphasized the human affinities of the ape-like chinless mandible. In the end, Smith Woodward's interpretation of the remains was accepted as the most accurate on the evidence then available. Incidentally, it is not generally realized that a fragment of the face of a second skull was found at some distance from the first by Dawson himself, but Dawson towards the end of his life had become difficult and he would never reveal the source of his discovery.

As a servant of the Trustees of the British Museum, Smith Woodward did magnificent work. His early labours in arranging the collections in their new quarters at South Kensington gave him an intimate knowledge of the material in the Museum, and as Keeper of Geology he spared no effort in making them as complete as possible. His aim to make them representative of every known fauna was mostly achieved by shrewd purchase and personal contact with the owners of private collections, whom he made a point of meeting during his travels. Exchanges too, he largely fostered, and a certain amount of material was obtained directly by the sending out of collectors into the field—and he himself made valuable discoveries in Greece at Pikermi, in Spain, South America and the Lebanon—but the day of expeditions on the grand scale had not yet arrived.

After his retirement he continued his scientific work vigorously until the end of his life, although his last few years were marred by blindness, and his last work, summarizing his views on early man and written in a popular style, remains to be published.

As an exponent of a difficult subject, Smith Woodward had few equals, whether to a technical or a lay audience, and those who heard him lecture will recall with pleasure his lucidity and the measured terms of his delivery.

The services of a man of his eminence were largely sought by the scientific societies to which he belonged, and in time he presided over most of them. In the Linnean Society he served on the Council for many years, as Vice-President for 1905–7, 1908–9, 1913–14 and 1923–24, and was President from 1919–23.

He also presided over the Geological Society (1914–16), the Geologists' Association (1904–6), Section C of the British Association (1909), Section H (1935), and of many local scientific societies throughout the country. He was for many years Vice-President of the Zoological Society and served on the Council of the Royal Society, of which he had been elected a Fellow in 1901. He was also a Foreign or Corresponding Member of many Academies and Societies abroad.

Smith Woodward's scientific work received wide recognition. The Geological Society awarded him the Wollaston Fund in 1889, a Lyell Medal in 1896 and the Wollaston Medal in 1924; the Royal Society, a Royal Medal in 1917; the French Academy, the Prix Cuvier in 1918; and in 1940 he received the Linnean Medal. Other awards were the Hayden Medal of the Philadelphia Academy of Natural Sciences, the Mary Clark Thompson Medal of the U.S. National Academy of Sciences, the Bolitho Medal of the Royal Geological Society of Cornwall, and the Clarke Memorial Medal of the Royal Society of New South Wales.

Of Academic honours, he had conferred upon him the LL.D. of St. Andrews and Glasgow, the Ph.D. of Tartu and the D.Sc. of Athens. On his retirement from the Keepership of Geology in 1924 he was knighted.

Smith Woodward was a man of imposing presence—he was six feet in height—and remarkable constitution, for in all the forty-two years of his service in the Museum he was absent on sick leave for only one half-day, when he fell and broke an arm in frosty weather! This undoubtedly affected his attitude towards those who were less fortunate in their health or less gifted in mind, whose difficulties he did not always readily appreciate. Dominant in character and a strict disciplinarian, he expected of others the same devotion to duty as he himself always so unsparingly gave and the same degree of accuracy in their work as that which was so characteristic of his own: but those who were trained under him had no reason to regret the strictness of their apprenticeship. Yet behind his somewhat stern official attitude there was much kindliness which was more readily revealed in the years when the cares of office had fallen from his shoulders. In some respects he was peculiarly sensitive, and controversy, such as that which centred around Piltdown Man, caused him acute anxiety, so great was his desire that his opinions should be well founded.

Outside the realm of Nature—in which we may include gardening in his later years—Smith Woodward had few interests, although he always appreciated classical music. He abhorred politics, and his devotion to his work left him no leisure for pastimes: he visited the theatre but rarely, and then only to take his children to a pantomime, for which he had a surprising relish.

Smith Woodward had an enormous circle of acquaintances—indeed, it may be said that he knew personally almost all those connected with the subjects in which he was interested, and he had an inexhaustible

fund of anecdotes concerning them. But his intimate friendship was given to few, and it may be said that he was at his happiest with his distinguished colleagues from overseas, whom he and Lady Smith Woodward delighted to entertain, first at their house in South Kensington and after his retirement at their beautiful home in Haywards Heath.

In his married life he was indeed fortunate. His wife was Maud, daughter of the late Dr. H. G. Seeley, F.R.S., Professor of Geology in the University of London, King's College, and with her he had a life of ideal companionship. Not only did Lady Smith Woodward help him as hostess in their home, but she accompanied him on all his travels after their marriage, and in his scientific work she acted as " lay critic ", for he always read his writings to her and valued her opinion in avoiding incidental obscurities. They had two children, a son who died in early manhood while an assistant magistrate in Borneo, and a daughter who, with Lady Smith Woodward and four grandchildren, survives him.

ERROL I. WHITE.

BENEFACTIONS.

LIST *in accordance with Bye-Laws, Chap.* 17, *Sect.* 1, *of all Donations of the amount or value of Twenty pounds and upwards, received during the past five years.*

1939

The Royal Society : Grant-in-aid of publications, £200.

The Percy Sladen Memorial Fund : Cost of printing and illustrating 'Transactions', 3rd ser., vol. i, part 1.

1940

The late Major J. R. G. Gwatkin : An extensive collection of paintings of flowering plants, mainly British.

The Royal Society : Grant-in-aid of publications, £100.

The Percy Sladen Memorial Fund : Cost of printing and illustrating 'Transactions', 3rd ser., vol. i, part 2.

1941

The late Mr. Francis Druce : (1) £200 for general purposes of the Society ; (2) a selection of books from his library, including some rare early botanical works.

Rockefeller Foundation : Donation in aid of publications, £100.

Carnegie Corporation of New York, $8,060, for the preparation of a photographic record of the collection and manuscripts of Carl Linnaeus.

The late Sir Arthur Evans : Portrait in oils of John Dionysius Ehret, F.R.S., by George James, A.R.A., 1767.

1942

Rockefeller Foundation : Donation in aid of publications, £200.

The Royal Society : Grant-in-aid of publications, £100.

India Office : Complete set of the Linnean Society of London's publications.

1943

Rockefeller Foundation : Donation in aid of publications, £100.

The Royal Society : Grant-in-aid of publications, £100.

1944

Rockefeller Foundation : Donation in aid of publications, £150.

The Royal Society : Grant-in-aid of publications, £50.

Mr. J. Insch : Donation to be used for the repair and binding of his collection of books on Tea, to be bequeathed to the Society, £100.

Gonville and Caius College : Donation in aid of the publication of Dr. V. J. Chapman's paper on the Vegetation of Jamaica, £50.

Lt.-Col. F. R. S. Balfour, C.V.O., J.P., D.L. : Transcription of the Journal of Archibald Menzies (1754–1842), bound in half leather ; 5 vols. quarto.

ADDITIONS AND DONATIONS

TO THE

LIBRARY

1943–44

Note.—Names of donors are given in square brackets. Separate copies of papers which are included in periodicals received by the Library are no longer catalogued.

Boulton, E. H. B., & Jay, B. Alwyn. British Timbers. Pp. 112. 8vo. *London*, 1944. [B. Alwyn Jay.]

British Museum (Natural History).

A Handbook for the identification of insects of medical importance. By John Smart. Pp. x+269. 8vo. *London*, 1943.

The John Murray Expedition, 1933–34. Scientific Reports. 4to. *London*, 1941–3.

Vol. 7, No. 4. Sipunculids and Echiurids of the John Murray Expedition to the Red Sea and Indian Ocean 1933–34. By A. C. Stephen. Pp. 401–409.

Vol. 7, No. 5. Paguridae and Coenobitidae. By E. F. Thompson. Pp. 411–426.

Economic Series: No. 2 A. Lice. By John Smart. Pp. 32. 1942. No. 5. The Bed-Bug. Ed. 5. By A. W. McKenny-Hughes and C. G. Johnson. Pp. iv+20. 1942. No. 15. Common insect pests of stored food products. By H. E. Hinton and A. Steven Corbet. Pp. 44. 1943. [Trustees, Brit. Mus. (Nat. Hist.).]

Calcutta. Royal Botanic Garden. The 150th Anniversary Volume. Pp. vi+301. 4to. *Alipore*, 1942. [Dr. K. Biswas.]

Campbell, D. H. Continental Drift and Plant Distribution. Pp. 43. 8vo. 1943. [Author.]

Carnegie Institution of Washington.

Papers from Tortugas Laboratory. Vol. 34. Pp. xiii+331. 8vo. *Washington*, 1941.

Scientific Results of Cruise VII of the "Carnegie" during 1928–1929 under Command of Captain J. P. Ault. Meteorology I and II; Biology—IV. 4to. *Washington*, 1943.

Papers from Tortugas Laboratory. Vol. 33. Pp. 195. 8vo. *Washington*, 1942.

Studies of evaporation and transpiration under controlled conditions. Pp. iv+48. 8vo. *Washington*, 1943. By Martin Emmett. [Carnegie Inst.]

Corbet A. Steven. *See* **British Museum (Natural History).** Economic Series, No. 15.

Crookes, Marguerite W. Plant Life in Maoriland. Pp. 192. 8vo. *Auckland*, 1926. [Prof. F. E. Weiss.]

Darwin, Erasmus. *See* **Krause, Ernst.**

Darwin, Leonard. *See* **Keynes, Margaret.**

Edlin, H. L. British Woodland Trees. Pp. ix+182. 8vo. *London*, 1944. [B. T. Batsford.]

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ASSOCIATION FOR THE STUDY OF SYSTEMATICS IN RELATION TO GENERAL BIOLOGY.

Annual Report—IV (1941–42)

and

Addendum up to 1 *January* 1945.

The third Annual Report of the Association was adopted at a General Meeting held on 10 July 1941 (published in Proc. Linn. Soc., 153rd Session, 1940–41, pt. 3, pp. 309–310).

During the year 1941/42 the activities of the Association have been practically at a standstill owing to the war. There have been no meetings of its Committees and only one joint meeting with the Linnean Society of London was held on 10 July 1941, when a discussion took place on ' Differences in the systematics of plants and animals and their dependence on the differences in structure, function and behaviour in the two groups '. A summary of the discussion has been published in the Proc. Linn. Soc. London, 153rd Session, 1940–41, pt. 3, pp. 272–287.

The *Bibliography of Key Works for the Identification of the British Fauna and Flora* was published during the year, and Founder Members of the Association and the Ordinary Members whose subscriptions for the year 1941–42 have been received, are entitled to a free copy on application to the Treasurer (Dr. John Smart, How Caple Court, Hereford). It is also on sale at the rooms of the Linnean Society of London, Burlington House, London, and at Adlard & Son, Ltd., Bartholomew Press, Dorking, Surrey, at the price of 7*s*. 6*d*. net (post free).

The Association's accounts for the period show a credit balance in the Ordinary Account of £85 2*s*. 10*d*., and in the Special Fund of £95 1*s*. 4*d*. The cost of printing the *Bibliography of Key Works* was outstanding at the time of taking these balances.

Membership : 12 Founder members and 85 ordinary members.

Addendum.

At the Annual General Meeting, held on 2 June 1942, in the rooms of the Linnean Society, the following resolution was passed :—

(1) The general activities of the Association be suspended, including the holding of an annual general meeting, and the issuing of an annual report.

(2) The present office-bearers and council remain in office to carry on the essential work relating to publications, etc., in such a way as they may see fit, e.g., by the formation of a small executive committee.

(3) Members be not asked for any subscriptions for the period of suspended activities, subject to the operation of clauses 4 and 5.

(4) New members joining the Association during the period of suspended activities be charged a single minimum subscription of 2*s*. 6*d*. in addition to the subscription due for the period antedated.

(5) The period during which the designation 'Founder Member' is applied to donors of £5 or more to the special fund be extended indefinitely.

(6) Subject to the operation of clause 2 (above), the Council is instructed to take steps for the resumption of the activities of the Association within a year of the termination of general hostilities, or earlier if they see fit.

The Treasurer has recently informed the Office-Bearers that, as at 1 January 1945 :—(i.) the membership had been increased since the last general meeting (1942) by two new Founder Members and eight new ordinary Members ; (ii.) *The New Systematics* continued to sell well ; (iii.) the *Bibliography of Key Works for the Identification of the British Fauna and Flora* is selling steadily, if slowly ; (iv.) the cost of printing, etc., of the *Bibliography of Key Works* had been met and there were no extraordinary outstanding liabilities other than the publication and circularization of this report ; (v.) the credit balances in the Ordinary Funds Account was £88 0*s.* 10*d.*, and that in the Special Fund Account was £119 9*s.* 7*d.*

J. S. L. Gilmour,
Hon. Botanical Secretary.

B. P. Uvarov,
Acting Hon. Zoological Secretary.

John Smart,
Hon. Treasurer.

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[A star * denotes the first publication of a name. Synonyms are not included.]

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ERRATA

Page 88, line 4—*for* nagavriska *read* nagavriksa.
Page 89, lines 6 and 7—delete one of the words ' English '.

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